REM IV

Remedial Planning Activities
at Selected Uncontrolled
Hazardous Waste Sites–Zone II

Environmental Protection Agency
Hazardous Site Control Division
Contract No. 68-01-7251

SDMS #94901

RECORD OF DECISION
PHOENIX-GOODYEAR AIRPORT
SUPERFUND SITE
GOODYEAR, ARIZONA

September 1989
RDD63605.RA
Work Assignment 30-9L19.0

CH2M HILL

Black & Veatch
ICF
PRC
Ecology and Environment

RECORD OF DECISION
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DECLARATION FOR THE RECORD OF DECISION

SITE

Phoenix-Goodyear Airport (PGA) Superfund site, Goodyear, Arizona.

PURPOSE

In accordance with the National Contingency Plan, the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), and the Superfund Amendment and Reauthorization Act of 1986 (SARA), potential remedial actions have been developed and evaluated for the PGA site. This decision document represents the U.S. Environmental Protection Agency's (EPA) preferred final remedy and remedial actions for the entire site. A Record of Decision for the Section 16 Operable Unit (OU) addressing groundwater contamination in Subunit A of the Upper Alluvial Unit (see Figure 2-1) within Section 16 was signed in September 1987. The Section 16 OU Record of Decision is consistent with the selected remedial actions represented in this Record of Decision. The Arizona Department of Environmental Quality and the Arizona Department of Water Resources concur with these selected final remedies.

BASIS

This decision is based on the administrative record for the PGA site, which includes the results of the Remedial Investigation (RI) conducted by EPA, Unidynamics Phoenix, Inc. (UPI), and the Goodyear Tire and Rubber Company, and the Feasibility Study (FS) conducted by EPA and UPI. Appendix A identifies all the items contained in the Administrative Record upon which the selection of the preferred remedial actions are based.

DESCRIPTION

The PGA site is located approximately 17 miles west of Phoenix, Arizona, in the western part of the Salt River Valley. The site covers a total area of about 35 square miles (Figure 1-1). Except for the airport, which is owned by the City of Phoenix, the PGA site lies almost entirely

within the City of Goodyear. The City of Avondale occupies about 2 square miles along the eastern border of the site. Current land uses consist predominantly of agriculture, but also include residential and industrial. Future land uses are predicted to become more residential. The combined population of the area was 30,000 people in 1985. The City of Goodyear expects to grow at a rapid pace, exceeding 140,000 people within the boundary of the PGA site in 20 years. Clusters of residential development are occurring west of the airport.

PREFERRED PLAN AND RATIONALE

A groundwater divide roughly follows the alignment of Yuma Road, effectively dividing the site into two distinct halves, north and south. UniDynamics Phoenix, Inc., undertook investigation of contamination in the north part of the site, while Goodyear Tire and Rubber Company and EPA completed the investigation for the south portion of the site. The preferred plan of action and rationale were developed for each portion of the site. Remedial actions for Subunit A groundwater in the south portion of the site were developed during an operable unit feasibility study completed in 1987. EPA selected extraction and treatment with air stripping as the preferred remedy. Goodyear Tire and Rubber Company is currently undertaking the design of the operable unit (OU) remedial action. The OU remedial action is consistent with the preferred plan as stated below. Therefore, the OU and the following remedies constitute the final remedy.

Based on the PGA RI/FS, the preferred alternative for the south portion of the site consists of extraction and treatment of Subunit B/C groundwater, and soil vapor extraction for the vadose zone.

- The groundwater alternative proposes the continued use of 20 existing wells for extraction and the addition of 3 more extraction wells. This alternative, which includes air stripping without carbon absorption, would result in reducing VOC concentrations in treated groundwater to levels equal to or less than Applicable or Relevant and Appropriate Requirements (ARARs). A central plant will be constructed to treat the water from all but one of the extraction wells. The remaining well will have treatment at the wellhead since it lies some distance from the airport. The treated

water will be provided to current users of the extraction wells, with the additional flow from the three new wells going to the City of Goodyear for municipal use. Total present worth cost for extraction and treatment is estimated at $9,160,000.

- Soil vapor extraction (SVE) for the area containing 99 percent of the mass of contaminants. This area corresponds approximately to Target Area 2 in the RI/FS. Under this alternative, VOCs would be extracted through a system covering approximately 284,100 square yards. Pilot testing conducted at this area of the site indicates that soil vapor extraction is an effective means of removing VOC contamination from the unsaturated vadose zone, thereby removing a source of potential groundwater contamination. All SVE units will be equipped with emission controls. Costs for SVE are estimated to range from $3,904,000 for a phased implementation to $5,370,000 for a full-scale implementation.

Based on the UPI RI/FS, the preferred alternatives for the northern portion of the site are the following:

- For groundwater, pump and treat Subunit A and Subunit C to equal to or less than ARARs. Groundwater treatment will consist of air stripping, followed by liquid phase granular activated carbon with granular activated carbon polishing on the air emissions. The end use will consist of either reinjection (treated groundwater from Subunit A) or incorporation into the community potable water supply (treated groundwater from Subunit C). The pumping rate for both subunits will be specified in the system design.

  If, in the implementation of the remedial action, EPA determines that air stripping cannot treat methyl ethyl ketone (MEK) to the level required by the ARARs, then hot air stripping and scale control methods will be employed unless EPA determines that the technology is impracticable. If the technology to treat MEK is impracticable, EPA will waive compliance with the MEK ARAR pursuant to CERCLA Section 121(d)(4), and set an alternative limit that is protective of human health and the environment.

Total cost is estimated at $12,157,000 for the Subunit A alternative and $1,870,000 for the Subunit C alternative.

- The soils will be treated with soil vapor extraction with emission controls. The target area consists of the area where VOCs were detected in soil samples and the area where soil gas samples quantified VOCs greater than 1 µg/l. The area may be expanded or reduced to include removal of 99 percent of the contaminants. Excavation and treatment may be required to remove residual contamination where soil vapor extraction is not effective. This includes soils contaminated with MEK and acetone.

  SVE costs are estimated to be $3,136,000. Costs for excavation and treatment will depend on the volume requiring removal which will be decided once the effectiveness of the SVE is determined. A total unit cost for treatment and disposal is estimated to be $715 per cubic yard.

DECLARATION

The selected remedy for this Operable Unit is protective of human health and the environment, meets Federal and State requirements that are applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the preference for treatment that reduces toxicity, mobility, or volume as a principal element. All substantive permit requirements will be met during the implementation of this remedial action. It is determined that the remedy for this Operable Unit uses permanent solutions and alternative treatment technologies to the maximum extent practicable. The Arizona Department of Environmental Quality and the Arizona Department of Water Resources have concurred with the remedy presented in this document.

Because this remedy will not result in hazardous substances remaining onsite above health-based levels, the five-year facility review will not apply to this action after completion of the remedial action.

9.26.89
Date

Daniel W. McGovern
for Regional Administrator
Region IX

RECORD OF DECISION
CONCURRENCE PAGE

Site: Phoenix-Goodyear Airport Superfund Site, Goodyear, Arizona

The attached Record of Decision package for the Phoenix- Goodyear Airport Superfund Site, Goodyear, Arizona, has been reviewed, and I concur with the contents.

9/22/89
Date

Gail Cooper, Acting Regional Counsel
Office of Regional Counsel
U.S. Environmental Protection
Agency, Region IX

9-15-89
Date

Jeff Zelikson, Director
Hazardous Waste Management Division
U.S. Environmental Protection
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9-15-89
Date

Harry Seraydarian, Director
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9.22.89
Date

David P. Howekamp, Director
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Sept. 21, 1989
Date

Nora McGee
Assistant Regional Administrator
Office of Policy and Management
U.S. Environmental Protection
Agency, Region IX

1. SITE DESCRIPTION

The Phoenix-Goodyear Airport (PGA) site covers a total area of about 35 square miles and is located about 17 miles due west of Phoenix, Arizona, in the western part of the Salt River Valley. Figure 1-1 illustrates the site location and site features. The City of Avondale occupies about 2 square miles along the eastern border of the site. Except for the airport, which is owned by the City of Phoenix, the remainder of the PGA site lies almost entirely within the City of Goodyear. The remaining land is presently used primarily for agriculture; however, residential development west of the airport is anticipated. The general area had a combined population of about 30,000 people in 1985.

The two major surface-water drainages within the area are the Gila River to the south and the Agua Fria River to the east. The Gila River flows perennially due to releases from treatment plants. The Agua Fria River is dry most of the year with occasional flows resulting from releases from dams, irrigation tailwaters, or treatment plants. The Agua Fria River drains south into the Gila River, which then flows to the west.

Drinking water supplies, industrial water supplies, and irrigation water come solely from groundwater that is pumped from the alluvial deposits of the western Salt River Valley underlying the entire area.

The site contains the Loral Corporation facility (formerly owned by Goodyear Aerospace Corporation [GAC]), the Phoenix-Goodyear Airport (formerly operated by the U.S. Navy), and UniDynamics Phoenix, Inc. All of these facilities have been identified as sources of contamination at the PGA site.

Figure 1-2 illustrates the chronology of the major activities conducted at the PGA site and places in perspective the timing and relationship between the Section 16 Operable Unit (OU) Record of Decision and this Record of Decision for the site as a whole.

A Record of Decision was approved for the Section 16 OU at the PGA site. The Section 16 OU addressed VOC-contaminated groundwater in Subunit A within Section 16. This Record of Decision addresses the vadose zone and remaining groundwater contamination for the entire site.

The following problem areas were defined during the PGA RI/FS:

1. Vadose zone contamination with VOCs in the vicinity of the former GAC facility and the Phoenix-Goodyear Airport

2. Contamination of the Subunit B/C aquifer south of the groundwater divide

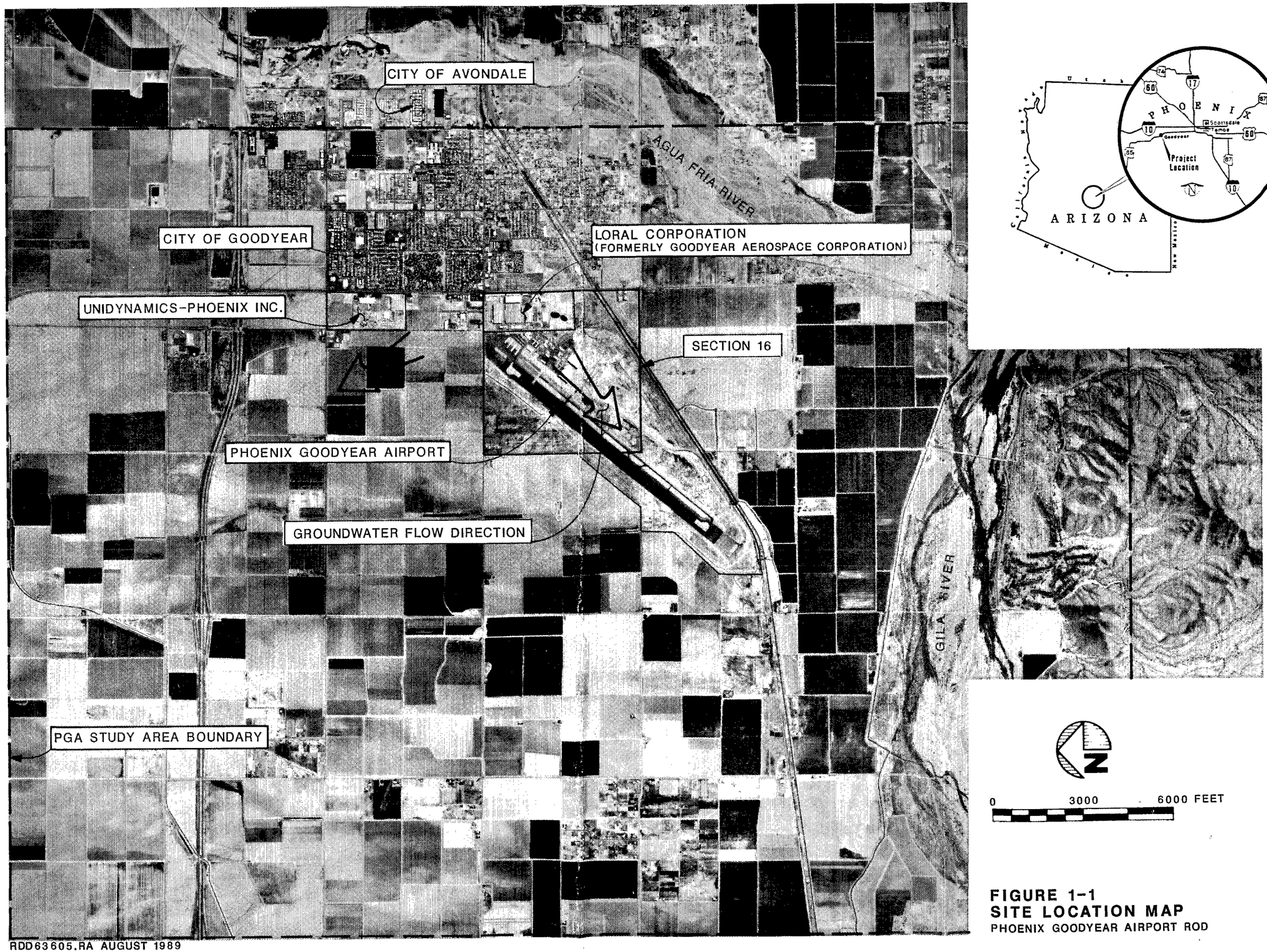
3. Vadose zone contamination with VOCs at the UPI facility

4. VOC contamination of Subunit A onsite and downgradient of the UPI facility

5. VOC contamination of the Subunit B/C aquifer onsite and downgradient of the UPI facility

6. Limited chromium contamination of soil and groundwater in the GAC sludge drying beds and adjacent areas

The PGA RI/FS describes these areas and problems in detail.



RDD63605.RA AUGUST 1989

FIGURE 1-1
SITE LOCATION MAP
PHOENIX GOODYEAR AIRPORT ROD

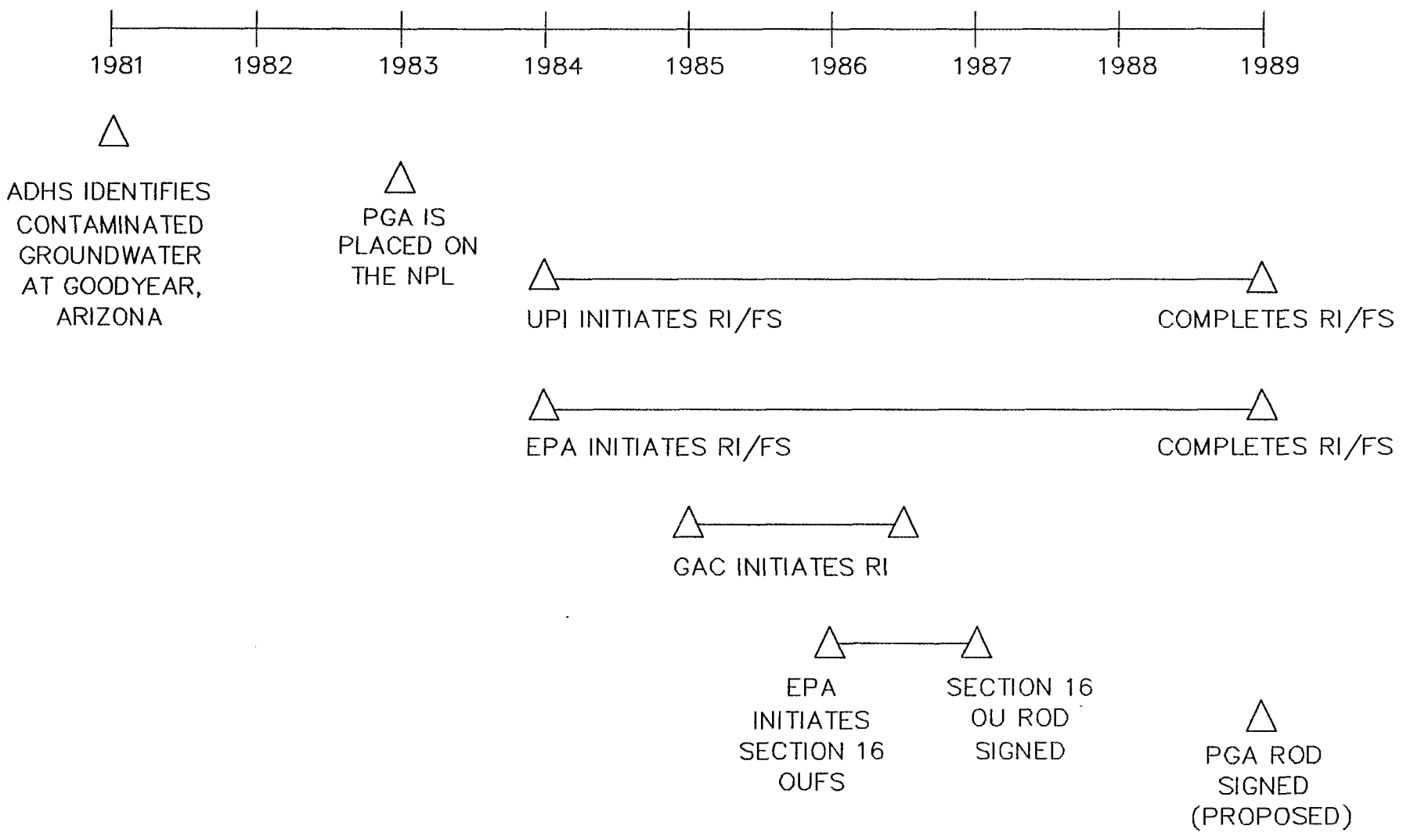


FIGURE 1-2
SUMMARY OF MAJOR ACTIVITIES AT PHOENIX GOODYEAR AIRPORT
PHOENIX GOODYEAR AIRPORT ROD

RDD63605.RA JULY 1989

2. SITE HISTORY AND BACKGROUND

SITE HISTORY

In 1981, the Arizona Department of Health Services discovered that groundwater in the PGA area was contaminated with solvents and chromium. Additional sampling of wells in 1982 and 1983 found 18 wells contaminated with trichloroethylene (TCE). As a result, the EPA added the PGA site to the National Priorities List in September 1983. In 1984, EPA began a Remedial Investigation of the Litchfield Airport Area (presently known as the Phoenix-Goodyear Airport) to characterize the site, investigate the extent of the contamination, and identify the potential sources.

Historical data indicate activities at three primary facilities contributed to the groundwater contamination at the PGA site:

- The former Goodyear Aerospace Corporation (GAC) facility owned by Goodyear Tire and Rubber, currently owned by Loral Corporation
- The Litchfield Park Naval Air Facility, currently the Phoenix-Goodyear Airport
- UniDynamics Phoenix, Inc. (UPI)

Historical data on waste handling at the former GAC facility, the airport, and the UPI facility can be found in the PGA Feasibility Study and the UniDynamics Phoenix, Inc., Feasibility Study, respectively.

Sampling data for groundwater identified two major areas of contamination, a northern area and a southern area. UniDynamics Phoenix, Inc., operates an industrial facility north of the former GAC facility across Yuma Road. UniDynamics Phoenix, Inc., undertook the preparation of a Remedial Investigation/Feasibility Study (RI/FS) report on the contamination identified north of Yuma Road and proximal to its facility. The area south of Yuma Road was investigated by the EPA, Goodyear Tire and Rubber, and the Corps of Engineers on behalf of the Department of Defense and the U.S. Navy. Most of the contamination in the southern area of the site is concentrated within Section 16.

This Record of Decision covers groundwater, with the exception of Subunit A water in the south portion, and soil

contamination, with the exception of the chromium-contaminated soils located in the sludge drying beds at the former GAC facility. The Goodyear Tire and Rubber Company is performing an expedited response action under an Administrative Order on Consent for the chromium sludge beds.

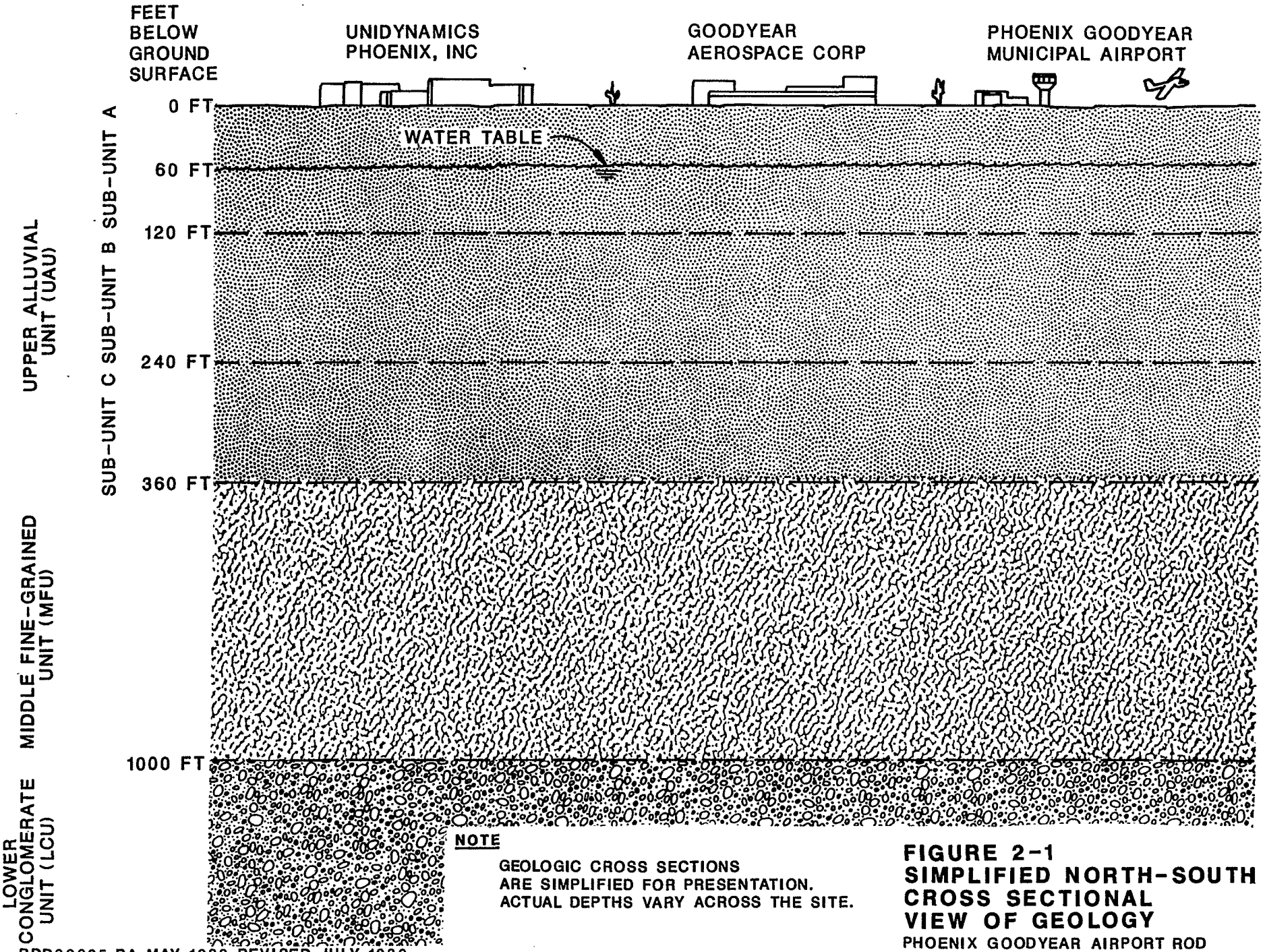
SITE CHARACTERIZATION

The site is located in a region having a climate characterized by long, hot summers and short, mild winters. Relative humidity is low, particularly during early summer, and the rainfall averages about 7.1 inches per year. The average daily maximum temperature in July is 107°F, the average daily minimum temperature in January is 34°F, and the average yearly temperature is 70°F. Temperatures vary between these extremes throughout the year.

Groundwater is pumped from the alluvial deposits of the western Salt River Valley. These deposits consist of the Upper Alluvial Unit, the Middle Fine-Grained Unit, and the Lower Conglomerate Unit, as shown in Figure 2-1. The Upper Alluvial Unit has been further subdivided into Subunit A, from the surface to about 120 feet deep; Subunit B, from about 120 to 240 feet deep; and Subunit C, from about 240 to 360 feet deep. Subunits A, B, and C are hydraulically connected.

Most wells in the area pump water from a zone between 100 and 600 feet deep. Depth to the water table has varied in the past, but recently has been measured between 40 and 100 feet below the ground surface. Groundwater flows in the PGA area are divided at approximately Yuma Road. The northern area, in the vicinity of UPI, has groundwater flows to the north or northwest, and the southern area, in the vicinity of the airport and the former GAC facility, has groundwater flows to the southwest and west.

In addition to the TCE and chromium mentioned earlier, several other compounds were found to contaminate the groundwater. Among these are perchloroethylene (PCE), 1,1-dichloroethylene (1,1-DCE), chloroform, and carbon tetrachloride. Table 2-1 identifies the wells tested, concentrations detected, and the applicable Federal or State standards or other criteria. Figures 2-2 through 2-4 show well locations where organic compounds were detected above ARAR concentrations at the PGA site. The highest



RDD63605.RA MAY 1989 REVISED JULY 1989

NOTE

GEOLOGIC CROSS SECTIONS
ARE SIMPLIFIED FOR PRESENTATION.
ACTUAL DEPTHS VARY ACROSS THE SITE.

FIGURE 2-1
SIMPLIFIED NORTH-SOUTH CROSS SECTIONAL VIEW OF GEOLOGY
PHOENIX GOODYEAR AIRPORT ROD

Table 2-1
COMPARISON OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
AND OTHER CRITERIA TO GROUNDWATER DATA

Well/ Station ID	Present Well Use	Compound	Concentration (µg/l)	ARAR[a] Exceeded	Other Criteria Exceeded
GROUNDWATER					
16EMW-1	Monitoring	Lead	Max-13	MCL, 5 µg/l[b]	
16EMW-2	Monitoring	1,1-Dichloroethylene	Max-9 Avg-<4	MCL, 7 µg/l	ADHS action level[c] --
		Trichloroethylene	Max-75 Avg-33	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
		Lead	Max-14 Avg-7.8	MCL, 5 µg/l MCL, 5 µg/l	
16EMW-3	Monitoring	1,1-Dichloroethylene	Max-140 Avg-126	MCL, 7 µg/l MCL, 7 µg/l	ADHS action level ADHS action level
		Trichloroethylene	Max-490 Avg-342	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
		Chromium (total)	Max-513 Avg-472	MCL, 100 µg/l[d] MCL, 100 µg/l	HA[e]--longer term/ 70 kg, lifetime HA--longer term/ 70 kg, lifetime
EMW-18B	Monitoring	Lead	Max-80 Avg-80	MCL, 5 µg/l MCL, 5 µg/l	
EMW-18UC	Monitoring	Lead	Max-80 Avg-<53	MCL, 5 µg/l MCL, 5 µg/l	
EMW-19B	Monitoring	Lead	Max-50 Avg-<37	MCL, 5 µg/l MCL, 5 µg/l	
EMW-19UC	Monitoring	Lead	Max-70 Avg-<47	MCL, 5 µg/l MCL, 5 µg/l	
EMW-19LC	Monitoring	Lead	Max-50 Avg-<37	MCL, 5 µg/l MCL, 5 µg/l	
		1,2-Dichloro-propane	Max-1.4 Avg-1.4		ADHS action level ADHS action level
		Chloroform	Max-3.1 Avg-3.1		ADHS action level ADHS action level
EMW-20B2	Monitoring	Lead	Max-80 Avg-<52	MCL, 5 µg/l MCL, 5 µg/l	
		Silver	Max-100 Avg-100	MCL, 50 µg/l MCL, 50 µg/l	
EMW-20UC	Monitoring	Lead	Max-60 Avg-<42	MCL, 5 µg/l MCL, 5 µg/l	
EMW-20LC	Monitoring	Lead	Max-50 Avg-<37	MCL, 5 µg/l MCL, 5 µg/l	
EMW-21UC	Monitoring	Lead	Max-50 Avg-<33	MCL, 5 µg/l MCL, 5 µg/l	
EMW-22LC	Monitoring	Lead	Max-50 Avg-<37	MCL, 5 µg/l MCL, 5 µg/l	
EMW-27MF	Monitoring	Lead	Max-70 Avg-<48	MCL, 5 µg/l MCL, 5 µg/l	
		Arsenic[e]	Max-47	MCL, 5 µg/l	

Table 2-1
(continued)

Well/ Station ID	Present Well Use	Compound	Concentration (µg/l)	ARAR[a] Exceeded	Other Criteria Exceeded
EMW-28B	Monitoring	Lead	Max-170 Avg-110	MCL, 5 µg/l MCL, 5 µg/l	
EMW-28UC	Monitoring	Lead	Max-90 Avg-<57	MCL, 5 µg/l MCL, 5 µg/l	
EMW-28LC	Monitoring	Lead	Max-90 Avg-80	MCL, 5 µg/l MCL, 5 µg/l	
16GMW-1	Monitoring	Trichloroethylene	Max-41.7 Avg-34	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
		Chromium (total)	Max-190 Avg-150	MCL, 100 µg/l MCL, 100 µg/l	HA--lifetime --
16GMW-2	Monitoring	Carbon tetrachloride	Max-5.1 Avg-<2		MCLG, ADHS action level MCLG, ADHS action level
		Methylene chloride	Max-13.2 Avg-<6.8		ADHS action level ADHS action level
		Trichloroethylene	Max-24.9 Avg-21	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
		Lead	Max-18 Avg-18	MCL, 5 µg/l MCL, 5 µg/l	
16GMW-3	Monitoring	1,1-Dichloroethylene	Max-12.8 Avg-10.8	MCL, 7 µg/l MCL, 7 µg/l	ADHS action level ADHS action level
		Carbon tetrachloride	Max-5.1 Avg-3.5		MCLG, ADHS action level MCLG, ADHS action level
		Trichloroethylene	Max-155 Avg-102.7	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
		Chromium (total)	Max-1,340 Avg-977	MCL, 100 µg/l MCL, 100 µg/l	HA--longer term/ 10 kg & 70 kg, lifetime HA--longer term/ 10 kg & 70 kg, lifetime
16GMW-3		Selenium	Max-18 Avg-16.7	MCL, 10 µg/l[f] MCL, 10 µg/l	
9UMW-1,2,3,4	Monitoring	Trichloroethylene	Max-350,000 Avg-<66,662	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
		Total Xylenes	Max-8,800 Avg-8,800	--	HA--10-day/10 kg, longer term/10 kg, lifetime
		Lead	Max-20 Avg-<7.2	MCL, 5 µg/l MCL, 5 µg/l	
9UMW-4	Monitoring	Methyl ethyl ketone	Max-11,000 Avg-11,000		ADHS action level ADHS action level
9UMW-5	Monitoring	Trichloroethylene	Max-3.3 Avg-<1.4		MCLG MCLG
		Lead	Max-20 Avg-<8.7	MCL, 5 µg/l MCL, 5 µg/l	

Table 2-1
(continued)

Well/ Station ID	Present Well Use	Compound	Concentration (µg/l)	ARAR[a] Exceeded	Other Criteria Exceeded
9UMW-6	Monitoring	Trichloroethylene	Max-6.5 Avg-4.2	MCL, 5 µg/l	ADHS action Level MCLG
		Lead	Max-10 Avg-<6.3	MCL, 5 µg/l MCL, 5 µg/l	
9UMW-7,8,9	Monitoring	Trichloroethylene	Max-140,000 Avg-23,744	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
9UMW-8	Monitoring	Methyl ethyl ketone	Max-900 Avg-900		ADHS action level ADHS action level
9UMW-11	Monitoring	Lead	Max-60 Avg-45	MCL, 5 µg/l MCL, 5 µg/l	
		Selenium	Max-80 Avg-<52.5	MCL MCL	
9UMW-12	Monitoring	Lead	Max-40 Avg-30	MCL, 5 µg/l MCL, 5 µg/l	
		Trichloroethylene	Max-450 Avg-<288	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
9UMW-13	Monitoring	1,2-Dichloroethane	Max-2.9 Avg-2.9		ADHS action level ADHS action level
		Chloroform	Max-5.9 Avg-5.9		ADHS action level ADHS action level
		Methylene Chloride	Max-19 Avg-19		ADHS action level ADHS action level
		Selenium	Max-80 Avg-<52.5	MCL MCL	
9UMW-14	Monitoring	Lead	Max-20 Avg-<12.5	MCL, 5 µg/l MCL, 5 µg/l	
9UMW-15	Monitoring	Trichloroethylene	Max-200 Avg-102	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
GAC #2	Industrial	Trichloroethylene	Max-16 Avg-9.8	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
GAC #3	Industrial	Trichloroethylene	Max-110 Avg-44	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
GAC #3		Chromium (total)	Max-170 Avg-170	MCL, 100 µg/l MCL, 100 µg/l	
GAC #4	Fire	Trichloroethylene	Max-45 Avg-12	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
PLA #2	Irrigation	Trichloroethylene	Max-36 Avg-12.4	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
PLA #3	Not in use	Trichloroethylene	Max-310 Avg-256	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
PLA #4	Not in use	Arsenic	Max-96 Avg-96	MCL, 5 µg/l MCL, 5 µg/l	HA--all categories
GF #4A	Irrigation	Trichloroethylene	Max-22 Avg-10.5	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level

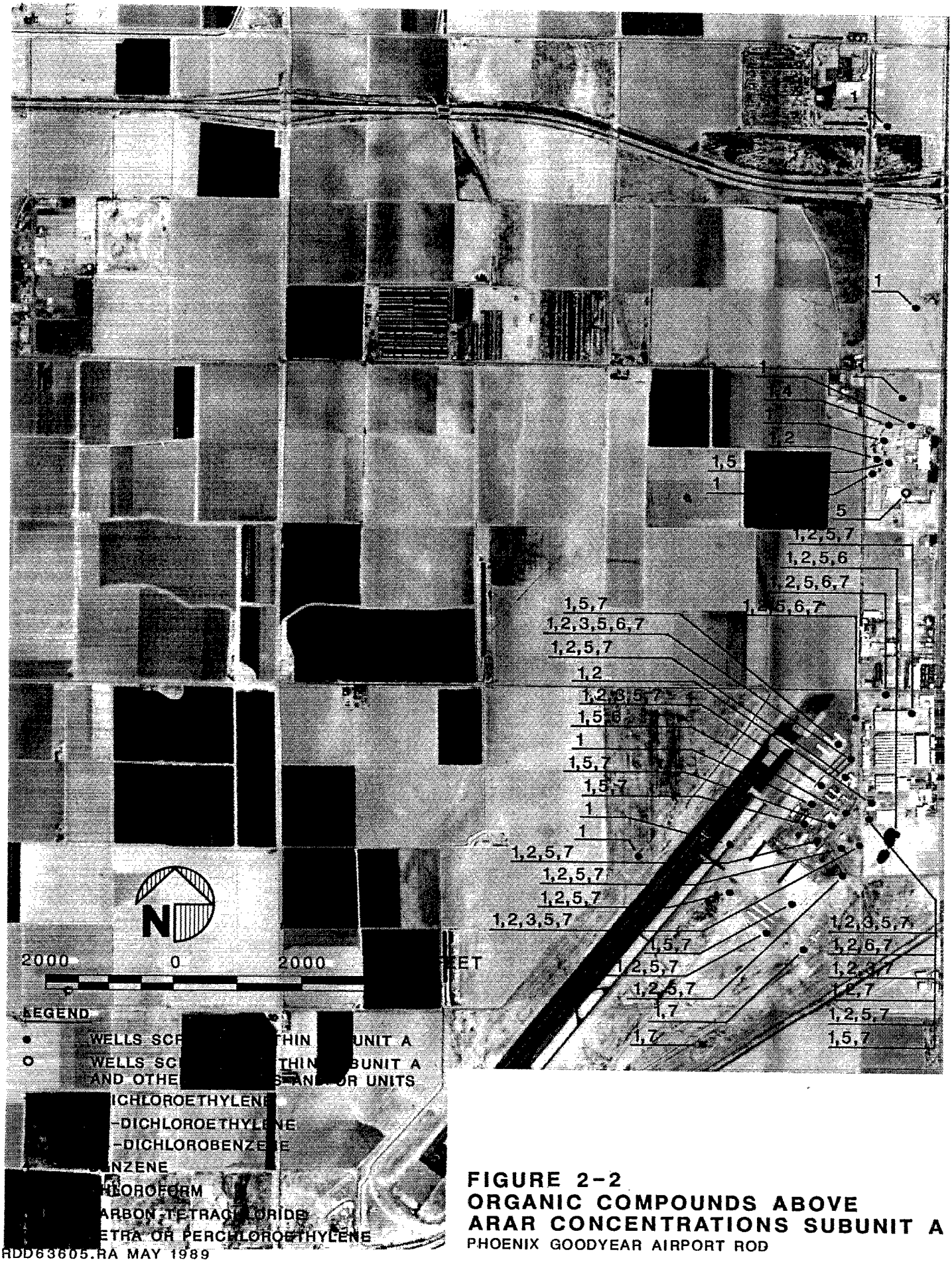
Table 2-1
(continued)

Well/ Station ID	Present Well Use	Compound	Concentration (µg/l)	ARAR[a] Exceeded	Other Criteria Exceeded
COG #1,2,3,6	Municipal	Lead	Max-24 Avg-<13	MCL, 5 µg/l MCL, 5 µg/l	
		Trichloroethylene	Max-6.8 Avg-<1.5	MCL, 5 µg/l	ADHS action level MCLG
COG #10	Municipal	Lead	Max-102 Avg-102	MCL, 5 µg/l MCL, 5 µg/l	
COTRIR	Irrigation	Trichloroethylene	Max-4.5 Avg-3.3		MCLG MCLG
DOMEST #3	Domestic	Trichloroethylene	Max-2.3 Avg-2.3		MCLG MCLG
PHILLIPS	Irrigation	Trichloroethylene	Max-12 Avg-10.3	MCL, 5 µg/l MCL, 5 µg/l	ADHS action level ADHS action level
PLUMB	Domestic	Trichloroethylene	Max-3 Avg-3		MCLG
R.WOOD1	Irrigation	Trichloroethylene	Max-3 Avg-2.5		MCLG MCLG
R.WOOD2	Irrigation	Trichloroethylene	Max-2 Avg-<1.3		MCLG MCLG
R5.6W3.5	Irrigation	Trichloroethylene	Max-1.7 Avg-<1.1		MCLG MCLG
RAYNER2	Irrigation	Trichloroethylene	Max-3 Avg-3		MCLG MCLG
RECMET2	Industrial	Trichloroethylene	Max-6 Avg-4.4	MCL, 5 µg/l	ADHS action level MCLG
S.SMITH2	Irrigation	Trichloroethylene	Max-3 Avg-2		MCLG MCLG
SHAWVER	Domestic	Trichloroethylene	Max-3 Avg-3		MCLG MCLG

[a]ARAR=Applicable or relevant and appropriate requirements.
[b]See U.S. EPA, 1988. The MCL for lead is proposed at 5 µg/l. This proposed standard was used in this analysis.
[c]ADHS action level=Arizona Department of Health Services action level.
[d]See U.S. EPA, 1989. The MCL for chromium (total) is proposed at 100 µg/l. This proposed standard was used in this analysis.
[e]HA=Health advisory.
[f]The current MCL for selenium is 10 µg/l. The proposed MCL is 50 µg/l (see U.S. EPA, 1989).

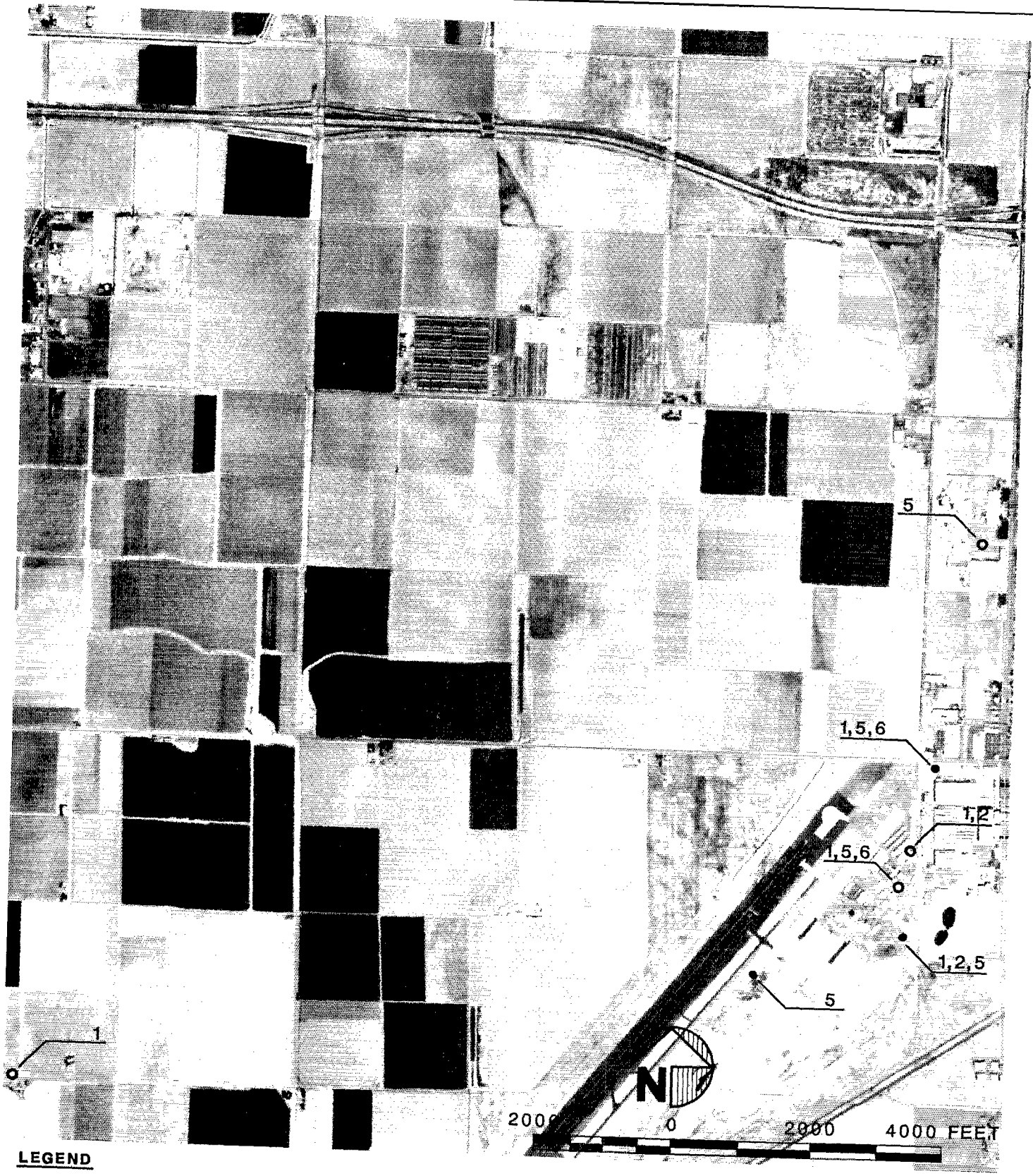
Notes:

MCL = Maximum contaminant level.
MCLG = Maximum contaminant level goal.



RDD63605.RA MAY 1989
REVISED AUGUST 1989

FIGURE 2-2
ORGANIC COMPOUNDS ABOVE ARAR CONCENTRATIONS SUBUNIT A
PHOENIX GOODYEAR AIRPORT ROD



LEGEND

- ● WELLS SCREENED WITHIN SUBUNIT B
- o WELLS SCREENED WITHIN SUBUNIT B AND OTHER SUBUNITS AND/OR UNITS
- 1 TRICHLOROETHYLENE
- 2 1,1-DICHLOROETHYLENE
- 5 CHLOROFORM
- 6 CARBON TETRACHLORIDE

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FIGURE 2-3
ORGANIC COMPOUNDS ABOVE ARAR CONCENTRATIONS SUBUNIT B
PHOENIX GOODYEAR AIRPORT ROD

contaminations levels are found in Subunit A, which is the shallower water-bearing zone, and migrates to the Subunit B/C zone.

Several organic and inorganic contaminants were detected in the soils at the site. Chromium, cadmium, aluminum, copper, TCE, and PCE were detected at concentrations exceeding the ADHS health-based cleanup levels. Table 2-2 includes the locations where ADHS levels were exceeded in soil samples. In addition, concentrations of methyl ethyl ketone and acetone were detected as high as 659 mg/kg and 888 mg/kg, respectively, in the northern portion of the site. Table 2-2 also includes contaminants detected in air samples which exceeded the ADHS guidelines. Carbon tetrachloride, benzene, TCE, and PCE exceeded the ADHS guidelines in air samples.

EXPOSURES

ENVIRONMENTAL RECEPTORS

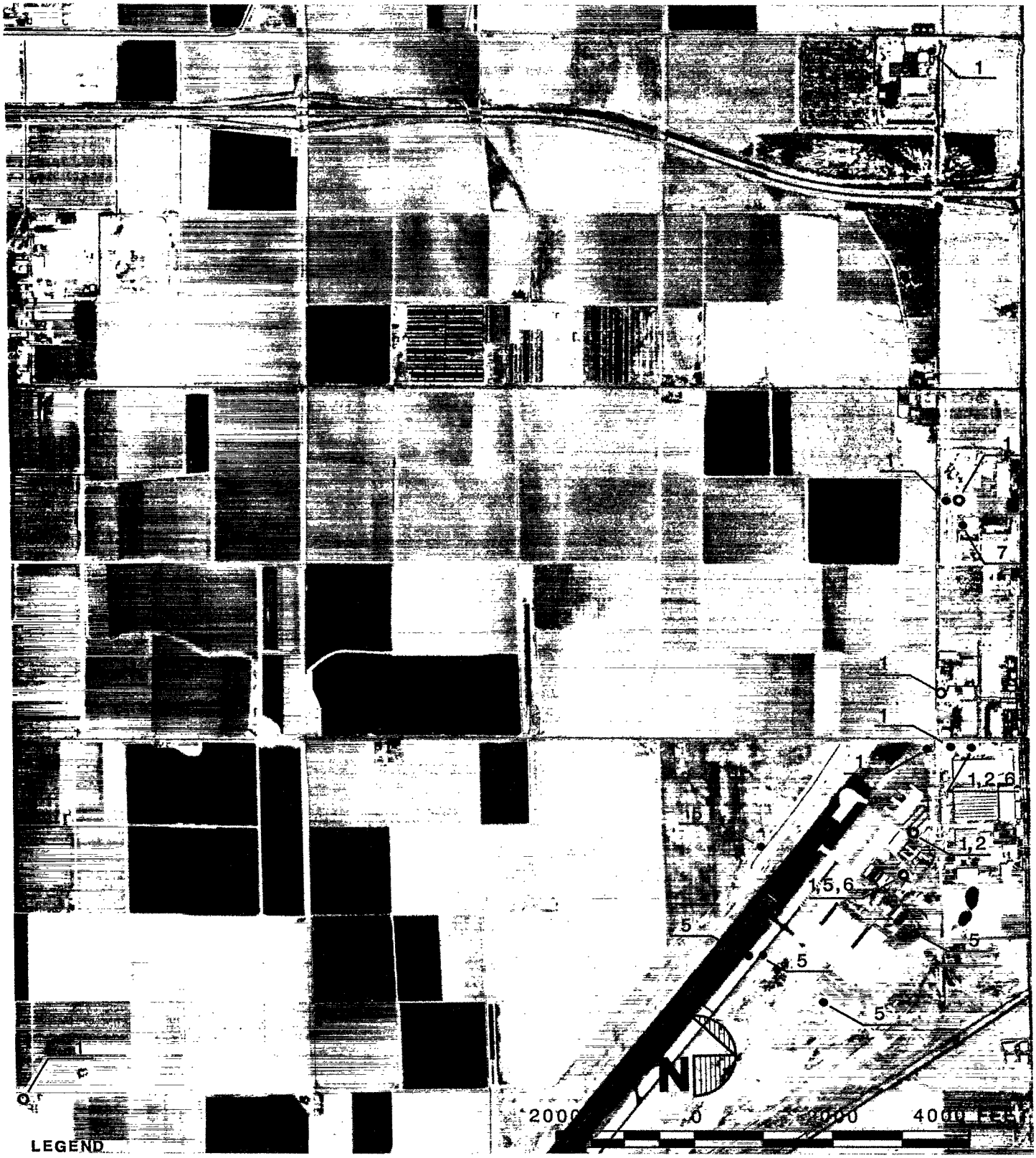
Within the PGA site, there are no unique habitats nor any threatened or endangered species. Native vegetation at the site is sparse. However, located immediately south of the site, the lower Gila River represents the important riparian habitat in southwestern Arizona. Species that inhabit or migrate through the area include four federally listed or endangered species: brown pelican (Pelecanus occidentalis), Yuma clapper rail (Rallus longirostris yumanensis), peregrine falcon (Falco peregrinus), and the bald eagle (Haliaeetus leucocephalus).

The PGA area, particularly near the Gila River, supports viable hunting populations of mourning dove, white-winged dove, Gambel's quail, and various waterfowl. The area is especially popular for dove hunting and is known to support one of the largest breeding dove colonies in the Southwest.

POPULATION CHARACTERISTICS/RECEPTORS

In 1985, the combined population of the Goodyear and Avondale area was 30,000. The City of Goodyear has stated in its general plan that the city expects to grow at a rapid pace, exceeding 140,000 people within 20 years. However, this may overestimate actual population growth.

Municipal wells contaminated above Federal and State standards have been taken out of service. All drinking



LEGEND

- ● WELLS SCREENED WITHIN SUBUNIT C
- ○ WELLS SCREENED WITHIN SUBUNIT C AND OTHER SUBUNITS AND/OR UNITS
- 1 TRICHLOROETHYLENE
- 2 1,1-DICHLOROETHYLENE
- 5 CHLOROFORM
- 6 CARBON TETRACHLORIDE
- 7 TETRA OR PERCHLOROETHYLENE

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FIGURE 2-4
ORGANIC COMPOUNDS ABOVE ARAR CONCENTRATIONS SUBUNIT C
PHOENIX GOODYEAR AIRPORT ROD

Table 2-2
COMPARISON OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
AND OTHER CRITERIA TO SOIL AND AIR DATA

Sample No.	Location	Compound	Maximum Concentration (mg/kg)	ARAR[a] Exceeded	Other Criteria Exceeded
SOIL					
All Test Pits	Former GAC Sludge Drying Beds; Background Sample Locations	Aluminum	16,410	--	ADHS Action Level[b]
All Test Pits	Former GAC Sludge Drying Beds	Cadmium	20.3	--	ADHS Action Level
Test Pit 0120	Background-Agricultural	Cadmium	1.2	--	ADHS Action Level
Test Pit 0606	Former GAC Sludge Drying Bed	Copper	303	--	ADHS Action Level
All Test Pits	Former GAC Sludge Drying Beds	Chromium	29,461	--	ADHS Action Level
16-GB-2	Former GAC Facility	Chromium	3,400	--	ADHS Cleanup Level
16-EP-4	Airport Drain Ditch Near Outfall 001	Aluminum	28,905	--	ADHS Cleanup Level
20-EB-6	Marsh Area South of U.S. 85	Aluminum	24,300	--	ADHS Cleanup Level
16-GB-4	Near Former GAC Sewerline	Copper	317	--	ADHS Cleanup Level
AC-2	Airport	TCE	1.4	--	ADHS Cleanup Level
AC-4	Airport	TCE	0.46	--	ADHS Cleanup Level
0903	Airport	TCE	2.51	--	ADHS Cleanup Level
0908	Airport	TCE	0.53	--	ADHS Cleanup Level
0909	Airport	TCE	0.338	--	ADHS Cleanup Level
0902	Airport	TCE	2.27	--	ADHS Cleanup Level
0910	Airport	TCE	0.45	--	ADHS Cleanup Level
16-GB-1	Former GAC Facility	PCE	0.150	--	ADHS Cleanup Level
03A	Waste Facility 3, UniDynamics	TCE	2.31	--	ADHS Cleanup Level
10A	Waste Facility 10, UniDynamics	TCE	1.28	--	ADHS Cleanup Level
12B	Waste Facility 12, UniDynamics	TCE	0.937	--	ADHS Cleanup Level
01A	Waste Facility 1, UniDynamics	TCE	860	--	ADHS Cleanup Level
04A	Waste Facility 4, UniDynamics	TCE	0.415	--	ADHS Cleanup Level

Table 2-2
(continued)

Sample No.	Location	Compound	Maximum Concentration (mg/kg)	ARAR[a] Exceeded	Other Criteria Exceeded
AIR					
All Surface/ Breathing Zone	All Locations	Carbon Tetra-chloride; Benzene	1.3 $\mu g/m^3$ 12.8 $\mu g/m^3$	--	ADHS Guideline
T-0915; Surface	Former GAC Facility	PCE	2.4 $\mu g/m3$	--	ADHS Guideline
T-0902; Surface	Former GAC Facility	TCE	8.2 $\mu g/m^3$	--	ADHS Guideline
B02; Surface	Upwind	PCE	3.0 $\mu g/m^3$	--	ADHS Guideline

[a]ARAR=Applicable or relevant and appropriate requirements.
[b]ADHS action level=Arizona Department of Health Services action level.

water wells currently in use for municipal supply meet applicable Federal and State health standards. However, future population growth will result in greater usage of groundwater resources, particularly in the contaminated areas. Use of the groundwater, and development of the surrounding areas, may result in potential exposures to contaminants through the means described in Figure 2-5, if no action is taken at this site and contamination migrates to areas that contribute to municipal groundwater supply.

TOXICITY

General information describing the toxicity of compounds identified at the PGA site is provided in the PGA RI/FS. Compounds discussed here include those that are considered to be the most significant site contaminants. The general toxicity characteristics are described for both the organic and inorganic contaminants.

ORGANIC COMPOUNDS

This group of compounds includes most of the contaminants identified at the PGA site. Several of these compounds--carbon tetrachloride, chloroform, 1,1,1-trichloroethane, PCE, and TCE--may produce liver injury. Carbon tetrachloride and chloroform have more serious effects on the liver than TCE and PCE (Doull et al., 1980). Carbon tetrachloride, chloroform, PCE, and TCE have been classified by the EPA Carcinogen Assessment Group (CAG) as probable human carcinogens (Group B2) via ingestion (U.S. EPA, 1989).

Exposures to the above compounds through inhalation may result in central nervous system depression, including anesthesia. Trichloroethylene has been used as an anesthetic (National Research Council [NRC], 1977). Other effects may include irritation of the mucous membranes of the nose and throat and irritation to the eyes (NRC, 1980). Trichloroethylene and PCE are also classified as probable human carcinogens by CAG via the inhalation route (U.S. EPA, 1989).

1,1-Dichloroethylene and trans-1,2-dichloroethylene exhibit similar toxic effects to humans through inhalation and ingestion exposures. These compounds have anesthetic properties, and exposures to high concentrations may cause nausea and vomiting (U.S. EPA, 1985a). The CAG has classified 1,1-DCE as a possible human carcinogen (Group C) for both inhalation and ingestion exposure routes (U.S. EPA, 1989).

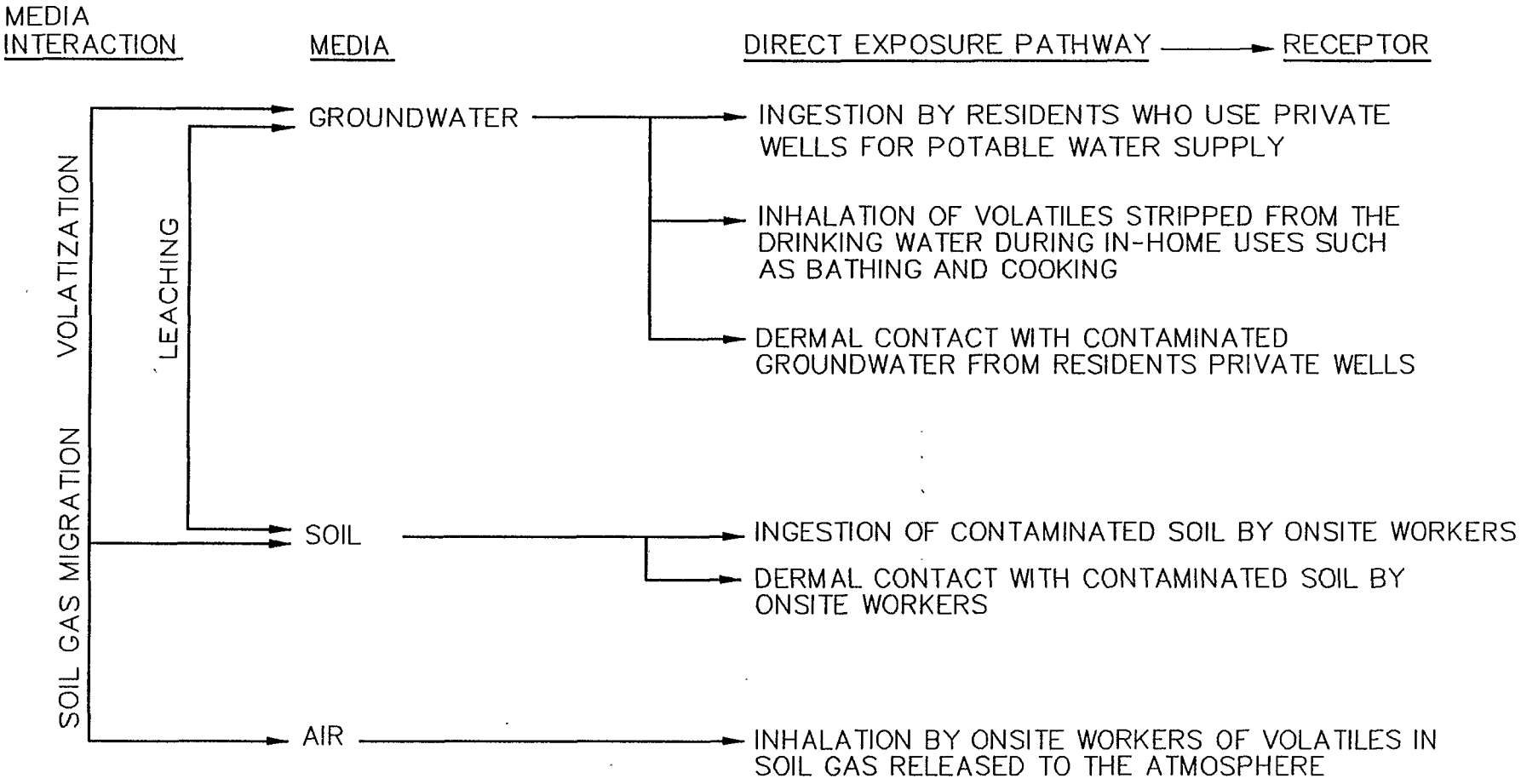

FIGURE 2-5
EXPOSURE PATHWAY AND RECEPTOR SUMMARY
PHOENIX GOODYEAR AIRPORT ROD

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INORGANIC COMPOUNDS

This group of compounds includes metals. Some of the inorganic compounds detected at the PGA site, such as chromium, are much more toxic than others.

Chromium has been identified in some water samples taken from the site in both the trivalent and hexavalent states. Chromium compounds in the trivalent (+3) state are of a low order of toxicity. In the hexavalent (+6) state, chromium compounds are irritants and corrosive and can enter the body by ingestion, inhalation, and through the skin (Sittig, 1981). Hexavalent chromium may cause liver and kidney damage, internal bleeding, and respiratory disorders (U.S. EPA, 1985b). Hexavalent chromium has been designated by the CAG as a human carcinogen (Group A) via the inhalation route (U.S. EPA, 1989).

RISK

Risk is a function of both exposure and toxicity. At present, the exposure to contaminated groundwater is limited, and the population and environment are not in any immediate danger. However, future use of contaminated groundwater will result in increased risks as shown in Table 2-3.

The risk associated with exposures to contaminated groundwater through drinking water ingestion, particularly for future use scenarios, is an estimated excess lifetime cancer risk. The overall future residential risk resulting from groundwater exposure could be as much as 4×10^{-3} to 9×10^{-4} based on the maximum-reported and average concentrations of carcinogens detected in groundwater at the site. For the northern portion of the site, the estimated excess lifetime cancer risk could go as high as 1×10^{-1} (one excess lifetime cancer occurrence per 10 people exposed over the course of a 70-year lifetime) based on the maximum reported TCE concentration in groundwater at the UniDynamics facility. For the southern portion of the site, the estimated excess lifetime cancer risk as a result of groundwater ingestion could go as high as 1×10^{-4} (one excess lifetime cancer occurrence per 10,000 people exposed over the course of a 70-year lifetime) based on the maximum reported TCE concentration in groundwater. Also for the southern portion of the site, the

Table 2-3
SUMMARY OF EXPOSURE ROUTES AND RISKS

Medium	Exposure Setting	Exposure Risk	Results
Groundwater	Residential--Current and Potential Uses	Ingestion	o For the Goodyear municipal wells (COG #1, 2, 3, and 6) there is an estimated excess lifetime cancer risk of 2 x 10^{-6} based on the maximum trichloroethylene concentration for these wells. There is no identified ingestion risk due to noncarcinogens. o For the private domestic wells PLUMB, SHAWVER, and DOMEST3, the risk due to trichloroethylene contamination of these wells can only be expressed qualitatively because fewer than three samples were collected from each well. A carcinogenic health risk may be present; however, the exact nature of the risk cannot be identified. There is no identified ingestion risk due to noncarcinogens from these wells.
		Inhalation	o The risk from inhalation of volatiles released from the groundwater in the course of in-home uses such as cooking, bathing, etc., cannot be quantified. However, it should be recognized that this exposure could contribute to the overall risk from the use of contaminated groundwater.
	Residential--Potential Use Only	Ingestion	o The estimated excess lifetime cancer risk from ingestion of ground water from the Unidynamics' monitoring wells presents the most significant risk values for the site that could be as much as 1 x 10^{-1} based on the maximum concentration of trichloroethylene. There is no identified ingestion risk due to noncarcinogens from these wells. o The GAC monitoring wells follow with estimated excess lifetime cancer risks that could be as high as 2 x 10^{-5} for carbon tetrachloride, 3 x 10^{-5} for chloroform, and 5 x 10^{-5} for trichloroethylene, all based on the maximum concentration of each constituent from the three wells. The daily intake of chromium in groundwater exceeded the AIC, RfD, and/or AIS value for ingestion exposures based on concentrations in 16GMW-1 and 16GMW-3. For other non carcinogens evaluated, there does not appear to be an ingestion risk based on the limited available data. o For the EPA monitoring wells for which enough data exist to quanUse tify estimated risks, there is an estimated excess lifetime cancer risk that could be as high as 1 x 10^{-4} for trichloroethylene, based on its maximum concentration, due to exposure through ingestion of groundwater. The daily intake of chromium in groundwater exceeded the AIC, RfD, and/or AIS value for ingestion exposures based on con centrations in 16EMW-3. For other noncarcinogens evaluated there does not appear to be an ingestion risk based on the limited avail able data. o For EPA Phase II monitoring wells, groundwater data are limited to two or three sampling rounds; therefore, risks were described qualitatively. All of these wells exhibited lead concentrations that exceeded the current or proposed MCL.

Table 2-3
(continued)

Medium	Exposure Setting	Exposure Risk	Results
Groundwater (cont'd)			o Other wells in the area that presented an estimated excess lifetime cancer risk due to trichloroethylene include the following: - GAC #3: 3×10^{-5} based on the maximum concentration - GAC #4: 1×10^{-5} based on the maximum concentration - PLA #2: 1×10^{-5} based on the maximum concentration - PLA #3: 1×10^{-4} based on the maximum concentration There was also an estimated excess lifetime cancer risk that could be as much as 6×10^{-3} for COG #5 (fire control well) due to the maximum concentration of arsenic. There is no identified ingestion risk due to noncarcinogens from these wells. o The risk from inhalation of volatiles released from the groundwater in the course of in-home uses such as cooking, bathing, etc., cannot be quantified. However, it should be recognized that this exposure could contribute to the overall risk from the use of contaminated groundwater.
Air	Occupational--Current and Potential Uses	Inhalation	o Based on inhalation of volatiles emitted from the onsite soil and an 8-hour exposure period, the estimated excess lifetime cancer risk for all compounds with a cancer potency factor for inhalation exposures considered could be as much as 1×10^{-4} to 2×10^{-5}. There is no known inhalation risk as a result of inhalation exposure to the noncarcinogens considered in the evaluation.

daily intake of chromium in groundwater exceeded the acceptable intake-chronic, the reference dose, and/or the acceptable intake-subchronic values for ingestion exposures, assuming chromium is in the hexavalent species.

The Arizona Department of Water Resources (ADWR) used a groundwater model to predict the effect on TCE concentrations based on a number of scenarios under the no action alternative. These scenarios, or base cases, are:

- Base Case 1--Continued agricultural pumpage at 1985 levels in addition to full implementation of City of Goodyear proposed wells. Section 16 Operable Unit not incorporated.

- Base Case 2--Pumpage and recharge assumed to remain constant at 1985 rates over modeling run. Section 16 Operable Unit incorporated.

- Base Case 3--Phase in City of Goodyear's projected production wells per the City of Goodyear's Water Master Plan. Phase out agricultural pumpage and recharge. Section 16 Operable Unit incorporated.

Trichloroethylene (TCE) concentrations were estimated for areas adjacent to selected municipal wells using the ADWR model. Table 2-4 presents the estimated TCE concentrations and the associated excess lifetime cancer risks as a result of ingestion of groundwater with the respective TCE concentration.

The estimated excess lifetime cancer risk as a result of TCE exposure through ingestion given the assumptions defined above could be as much as 3×10^{-6} for the highest estimated concentration.

This particular evaluation does not consider the effect of exposure to other contaminants detected in groundwater at the PGA site and therefore may underestimate the total risk. This assessment also only considers exposures through ingestion; however, additional exposures may be anticipated through inhalation of volatiles as a result of in-home uses of groundwater and exposures through dermal contact with the contaminated groundwater.

For the southern portion of the site, the inhalation risk to onsite workers as a result of volatile emissions from soil could be as much as 1×10^{-4} to 2×10^{-5} (8-hour exposure) based on all volatile compounds detected with a cancer

Table 2-4
ESTIMATED EXCESS LIFETIME CANCER RISK DUE TO TCE EXPOSURE
BASED ON IMPLEMENTING THE NO ACTION ALTERNATIVE[a]

Well ID	Base Case 1 TCE Conc. (µg/l)	Estimated Excess Lifetime Cancer Risk[b]	Base Case 2 TCE Conc. (µg/l)	Estimated Excess Lifetime Cancer Risk[b]	Base Case 3 TCE Conc. (µg/l)	Estimated Excess Lifetime Cancer Risk[b]
COS School District	0	--[c]	0	--	0	--
COG 2	<1	$<3 \times 10^{-7}$	<1	$<3 \times 10^{-7}$	<1	$<3 \times 10^{-7}$
COG 3	0	--	0	--	0	--
COG 8	<1	$<3 \times 10^{-7}$	<1	$<3 \times 10^{-7}$	<1	$<3 \times 10^{-7}$
COG 11	10.5	3×10^{-6}	4.0	1×10^{-6}	11	3×10^{-6}
COG PW 1	0	--	--	--	0	--
COG PW 2	<1.0	$<3 \times 10^{-7}$	--	--	<1.0	$<3 \times 10^{-7}$
COG PW 3	1.7	5×10^{-7}	--	--	<1.0	$<3 \times 10^{-7}$
COG PW 4	<1.0	$<3 \times 10^{-7}$	--	--	<1.0	$<3 \times 10^{-7}$
COG PW 5	<1.0	$<3 \times 10^{-7}$	--	--	<1.0	$<3 \times 10^{-7}$
COG PW 6	3.4	1×10^{-6}	--	--	1.9	6×10^{-6}
COG PW 7	<1.0	$<3 \times 10^{-7}$	--	--	<1.0	$<3 \times 10^{-7}$

[a] Based on the level of TCE (µg/l remaining in groundwater adjacent to selected municipal wells.

[b] Based on the following assumptions: 2 l/day intake; 70 kg bodyweight; 70-year exposure duration; LAWI = 0.029 l/kg/day.

[c] -- = Data not available.

potency factor for inhalation. Likewise, based on air samples collected in upwind areas, the inhalation risk to onsite workers could be as much as 2×10^{-5} based on an 8-hour daily exposure over the course of a work lifetime.

More information on health effects associated with contaminants found at the PGA site can be found in Appendix R of the PGA RI/FS Report.

CLEANUP LEVELS AND APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

As part of the final remedy, EPA is setting cleanup levels for the soils and groundwater at the PGA site. Cleanup levels are set by considering the statutory factors set forth in CERCLA Section 121. In particular, determining cleanup levels requires compliance with CERCLA Section 121(d). This requires, at a minimum, that the remedial action "attain a degree of cleanup...which assures protection of human health and the environment...." CERCLA Section 121(d)(1). Moreover, cleanup standards must comply with standards under Federal environmental laws and more stringent, promulgated standards under State laws which are "legally applicable...(or are) relevant and appropriate

under the circumstances...." CERCLA Section 121(d)(2). Applicable or relevant and appropriate requirements (ARARs) may be waived at the discretion of EPA if criteria set forth in CERCLA Section 121(d)(4) are met.

For this remedial action, it is appropriate to set cleanup levels for soils and groundwater. For groundwater, EPA performed independent analyses of appropriate cleanup level for Subunit A and Subunit B/C because of different, site-specific, groundwater quality concerns.

Soils

EPA has identified no chemical-specific ARARs defining cleanup levels for soils at either the northern or southern portions of the site. EPA is setting its cleanup level for soils based on the need to protect human health and the environment from the contamination of groundwater (both Subunits A and B/C) which would result without a cleanup of soils.

EPA's soil cleanup standard for volatile organic compounds is to remove those contaminants from the soil until EPA is convinced the levels remaining will not cause or contribute to the contamination of groundwater in levels in excess of the cleanup standards for groundwater discussed below. The volume of contaminants to remain in the soil will be determined using a decision-tree that was developed by the PGA Committee members. This decision-tree will be used in the implementation of the remedial action.

For chromium and other metal contamination in the sludge pits on the southern portion of the PGA site, EPA will set final cleanup levels through an administrative order to Goodyear Tire and Rubber Company. This order will require Goodyear to remove metals to level sufficient to ensure that the soils will not be a source of contamination to the groundwater in excess of the cleanup standards for groundwater discussed below.

Groundwater

For both Subunits A and B/C of the PGA site, EPA is establishing cleanup levels as set forth in Table 2-5.

These cleanup levels are to be met throughout the aquifer.

Table 2-5
LEGALLY APPLICABLE
STATE AND FEDERAL REQUIREMENTS AND OTHER CRITERIA
FOR GROUNDWATER
(Concentrations in µg/l)

Compound	Legally Applicable SDWA MCL	Other Criteria				
		AWQC--Drinking Water Only		ADEQ Action Level Water	Proposed MCL	Cleanup Level
		Toxicity	Cancer 10^{-6} Risk			
1,1-Dichloroethylene	7		0.033	1		7
1,2-Dichloropropane				1	5	1
Chloroform	100		0.19	3	200	100
Toluene		15,000		340		340
Trichloroethylene	5		2.8	5		5
Trichlorofluoromethane				1		1
Carbon Tetrachloride	5			5		5
Methylene Chloride				1		1
Methyl Ethyl Ketone			170	170		170
Xylenes				440	10,000	440
Antimony		1.46				1.46
Arsenic	50		0.0025			50
Barium	1,000				5,000	1,000
Beryllium			0.0039		5,000	0.0039
Cadmium	10	10			5	10
Chromium	50	50			100	50
Lead	50	50			5	50
Mercury	2	10				2
Nickel		15.4				15.4
Selenium	10	10			50	10
Silver	50	50				50
Zinc		5,000				5,000

Notes: ADEQ = Arizona Department of Environmental Quality.
AWQC = Ambient Water Quality Criteria; adjusted for consumption of drinking water only; fish ingestion component removed (U.S. EPA, 1986).
AWQC (10^{-6}) = The Ambient Water Quality Criteria resulting in a 10^{-6} excess lifetime cancer risk (U.S. EPA, 1986).
MCL = Maximum Contaminant Level.
MCLG = Maximum Contaminant Level Goal.
SDWA = Safe Drinking Water Act, 40 CFR 141, November 15, 1985.

Source: U.S. EPA, 1987. IRIS Database.
Proposed MCLs - Federal Register, May 22, 1989.

Subunit B/C

Subunit B/C is a potential source of drinking water, and therefore it is relevant and appropriate to use maximum contaminant levels (MCLs) set pursuant to the Safe Drinking Water Act as cleanup levels for contaminants covered by MCLs. This approach is consistent with Arizona law (discussed in more detail below) which establishes the MCLs are to be used as aquifer water quality standards as part of the process for defining aquifer cleanup levels. Health-based levels are designed as cleanup levels where they are more stringent than MCLs or where no MCL exists for a contaminant.

Subunit A

Subunit A is not a potential source of drinking water as defined by the Safe Drinking Water Act and EPA's Groundwater Protection Strategy because of its elevated levels of total dissolved solids and nitrates. Because of this, the Safe Drinking Water Act is not a basis for cleanup levels in Subunit A. EPA's determination of cleanup levels in Subunit A is based on the statutory requirement that cleanup levels protect human health and the environment, RCRA corrective action requirements, and Arizona cleanup standards. Each of these criteria result in the cleanup levels in Table 2-5 applying in Subunit A. As discussed below, further analysis, at least possibly, could result in some modification to EPA's determination of cleanup levels based on the above three criteria. In such event, in setting cleanup levels, EPA would also consider the statutory preference for treatment remedies which permanently and significantly reduce the volume, toxicity, or mobility of contaminants.

Protection of Subunit B/C

The cleanup levels in Table 2-5 for Subunit A are necessary to prevent the migration of contaminants to Subunit B/C at levels in excess of health-based levels and ARARs. UniDynamics, Inc., has contended that higher cleanup levels could be set for Subunit A while still protecting Subunit B/C. However, UniDynamics has not, to date, established a basis for any levels other than those set forth in Table 2-5. Should EPA determine that other levels are appropriate to protect Subunit B/C, EPA would consider revising the cleanup levels in the ROD. However, such a revision would have to be consistent with EPA's ARARs determinations discussed below.

RCRA Corrective Action

RCRA's corrective action requirements are relevant and appropriate to setting the cleanup levels for Subunit A. Pursuant to RCRA and its implementing regulations, corrective action requires compliance with MCLs established pursuant to RCRA at the boundary of the unit. Where RCRA MCLs are not available, EPA applies Safe Drinking Water Act MCLs and health-based limits as the alternate concentration limit (ACL) for contaminants covered by those MCLs and health-based limits. In an appropriate case, EPA can allow different ACLs to apply if EPA determines that the hazardous constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded.

As applied to this case, EPA is setting the levels in Table 2-5 as the ACLs for Subunit A. The point of compliance for these ACLs is the boundary of the locations into which the contaminants were released; e.g., the boundaries of the disposal pits, extending vertically through Subunit A. These ACLs apply unless EPA determines that the substantive requirements for different ACLs are satisfied. These substantive requirements are set forth at 40 CFR Section 264.94(b),(c).

Arizona Law

Arizona law establishes a comprehensive scheme for classifying and protecting aquifers. Portions of this scheme are relevant and appropriate in defining the cleanup levels for Subunit A. Under Arizona law, Subunit A is classified for drinking water protected use, and is subject to aquifer water quality standards. These standards include MCLs established pursuant to the Safe Drinking Water Act. Arizona law also establishes statutory and regulatory requirements governing the selection of cleanup remedies for contaminated aquifers. EPA believes that the Arizona groundwater classification scheme, as applied through the Arizona statutory and regulatory criteria for selection of cleanup remedies, is relevant and appropriate to the setting of cleanup levels.

As applied here, Subunit A is protected for drinking water uses because it is part of a definable aquifer and has not received an aquifer exemption. Therefore, Safe Drinking Water Act MCLs are water quality standards for Subunit A. Pursuant to Arizona law, cleanups must achieve the maximum protection of drinking water (i.e., compliance with aquifer

water quality standards) consistent with the other requirements for selection of remedial actions.

EPA interprets this requirement here to require the cleanup of Subunit A to achieve MCLs unless that is not cost-effective; not reasonable and necessary to prevent, minimize, or mitigate danger to public health or welfare or to the environment; or inconsistent with other relevant aspects of Arizona water law. In this case, EPA determines that complying with MCLs is cost-effective, is reasonable and necessary to prevent, minimize, or mitigate danger to public health, welfare, and the environment, and can be achieved consistent with relevant Arizona water law. Therefore, MCLs are ARARs for Subunit A throughout the subunit, unless Subunit A qualifies for an aquifer exemption, or EPA has reason to alter its determination as to whether achieving such levels is cost-effective, reasonable and necessary, or achievable consistent with Arizona water law.

3. ENFORCEMENT HISTORY

PHOENIX-GOODYEAR AIRPORT AND FORMER GAC FACILITY

The responsible parties identified for the PGA site are:

- Goodyear Tire and Rubber Company for activities at the former Goodyear Aerospace Corporation facility. The facility has been sold to the Loral Corporation, who has not been named a responsible party.
- United States Department of Defense, on behalf of the United States Navy who operated the Litchfield Naval Air Base. The Litchfield Naval Air Base was sold to the City of Phoenix in 1968 and is now the Phoenix-Goodyear Municipal Airport.
- UniDynamics Phoenix Incorporated for activities at its facility.

The remedial actions for the south half of the site, the Phoenix-Goodyear Airport and former GAC facility, will be the responsibility of the Goodyear Tire and Rubber Company and the Department of Defense.

Goodyear Tire and Rubber has been participating in the RI/FS since 1984. Its efforts have been concentrated on determining the extent of soil contamination at the former GAC facility and the extent of groundwater contamination underneath the facility and the airport. A history of EPA enforcement actions toward Goodyear Tire and Rubber includes:

- July 23, 1982--RCRA Section 3007/CERCLA Section 104 request for information issued to Goodyear Tire and Rubber
- March 27, 1984--General notice letter sent to Goodyear Tire and Rubber from EPA
- March 27, 1984--RCRA Section 3013/CERCLA Section 106 Administrative Order on Consent issued to Goodyear Tire and Rubber
- December 20, 1984--Violation of the Clean Water Act issued to Goodyear Tire and Rubber from EPA

- January 14, 1986--Violation of the Clean Water Act issued to Goodyear Tire and Rubber from EPA

- March 19, 1986--CERCLA Section 106 Administrative Order on Consent signed by Goodyear Tire and Rubber and EPA

- April 22, 1987--CERCLA Section 106 Administrative Order for the implementation of the Section 16 groundwater remedial action--The order was prepared during negotiation of the Consent Decree for the remedial action but was not issued.

- 1987--Sidebar agreement between Goodyear Tire and Rubber Company and the Department of Defense for the Section 16 groundwater remedial action--This agreement was a result of the alternative dispute resolution (ADR) process, and apportioned the financial contributions of the two responsible parties.

- 1988--CERCLA Consent Decree between U.S. EPA and Goodyear Tire and Rubber Company for the Section 16 groundwater remedial action

Between 1945 and 1968, the U.S. Navy operated the Litchfield Park Naval Air facility adjacent to the GAC facility. The Navy had sold the Naval Air facility to the City of Phoenix in 1968 for use as a municipal airport. The U.S. Corps of Engineers was assigned in May 1985 to represent the Department of Defense on the Phoenix-Goodyear Airport Interagency Committee, which was established by EPA to involve state and local agencies as well as responsible parties in CERCLA actions at the site.

UNIDYNAMICS PHOENIX, INC.

A history of EPA enforcement actions toward UniDynamics Phoenix, Inc., includes:

- 1986--RCRA Section 3013/CERCLA Section 106 Administrative Order on Consent was issued to UniDynamics Phoenix, Inc., from EPA (Docket No. 86-02).

- July 30, 1987--A Supplemental Order was issued to UniDynamics Phoenix, Inc., from EPA under RCRA

Section 3013 for installation of additional monitoring wells and collection of soil samples (Docket No. 86-02).

- February 6, 1989--An Order was issued to UniDynamics Phoenix, Inc., from EPA under CERCLA Section 106, for submission of an RI/FS report (Docket No. 89-04).

- May 5, 1989--Finding of violation of the terms of Order 89-04 was issued February 6, 1989. UniDynamics resubmitted the required deliverables to correct the deficiencies which caused the finding of violation.

4. COMMUNITY RELATIONS HISTORY

The following is a list of community relations activities conducted by the U.S. EPA at the PGA Superfund site (formerly the Litchfield Airport Area site):

- EPA conducted interviews with Goodyear and Avondale residents and State and local officials in 1984 to improve EPA's understanding of community concerns. These interviews provided the basis for the Phoenix-Litchfield Airport Area Community Relations Plan released in October 1984.

- EPA established information repositories at the Avondale Public Library, Phoenix Public Library, and the Arizona Department of Health Services. EPA updated repositories periodically with factsheets and other relevant documents.

- EPA established a computerized mailing list with over 200 addresses of interested individuals.

- EPA contributed PGA-related information to Groundwater Quality Update, a newsletter that provides information about groundwater quality to interested parties, prepared and distributed by the Arizona Department of Health Services.

- EPA distributed a factsheet in July 1984 which provided an overview of the Superfund process, gave a brief description of the PGA site contamination, and described proposed remedial investigation/feasibility study (RI/FS) activities.

- EPA held a community meeting on August 1, 1984, to provide an overview of the Superfund process and information on past site activities and outline future RI/FS activities.

- EPA distributed an "Update on Site Activities" factsheet in February 1985 which described ongoing RI/FS activities including water level measurement and water quality sampling, soil boring and sampling, well installation, and computer modeling.

- EPA released the "Water and Soil Sample Results" factsheet in June 1985 which reported the results

of the soil and water sampling, and discussed how this information would be used in the second phase of the RI/FS.

- EPA held a community meeting on February 19, 1986, to report the Remedial Investigation (RI) Phase I results, and to discuss the additional information needed to complete the RI and the plan for obtaining this information during the upcoming RI Phase II activities.

- EPA sent out a factsheet in January 1987 which provided groundwater sampling results and discussed the Operable Unit Feasibility Study (OUFS).

- EPA distributed a factsheet in May 1987 announcing the release of the OUFS and the beginning of a public comment period for the study, as well as announcing a community meeting on June 4, 1987.

- EPA held a public comment period from June 2, 1987, to July 2, 1987, on the draft OUFS and prepared a responsiveness summary to address the comments received.

- EPA announced the public comment period on the draft OUFS and the public meeting with a public notice placed in Goodyear's weekly newspaper Westsider which ran on Thursday, May 28, 1987, and Thursday, June 4, 1987.

- EPA distributed a factsheet in October 1987, describing the treatment system proposed for the Section 16 OU.

- EPA distributed a factsheet in December 1988 updating the public on site-related activities. The factsheet included the terms of the agreement finalized with Goodyear Tire and Rubber, the Department of Defense, and EPA concerning cleanup activities for the Section 16 OU.

- EPA distributed a factsheet in May 1989 announcing the release of the Feasibility Study and preferred remedy for public comment.

- EPA held a public meeting on June 21, 1989, to solicit public input on the RI/FS and preferred remedy.

- o EPA held a public comment period on the RI/FS report from June 7 to July 7, 1989. A response summary to address the comments received is included as Appendix B of this ROD.

In addition, EPA will continue to conduct ongoing community relations activities at the PGA site throughout the duration of the remedial action.

5. ALTERNATIVES EVALUATION

A range of remedial action alternatives were evaluated for the volatile organic compound (VOC)-contaminated vadose zone and groundwater in Subunit B/C and Subunit A outside of Section 16 in the northern portion of the site. Alternatives were evaluated based on their ability to meet the remedial response objectives.

PHOENIX-GOODYEAR AIRPORT AND THE FORMER GAC FACILITY

The soil and vadose zone investigations identified two problem areas:

- VOC-contaminated soils on the Phoenix-Goodyear Airport and former Goodyear Aerospace Corporation (GAC) facility
- Contaminated soils associated with the former chromium sludge beds

Chromium-contaminated soils were not considered in this evaluation since Goodyear Tire and Rubber will perform the remedial action for the chromium-contaminated soil under an Administrative Order on Consent.

A wide range of technologies was identified for VOC-contaminated soil. The remedial response objectives for contaminated soil are to:

- Protect public health and the environment from exposure to VOC-contaminated soil
- Prevent migration of VOCs that would result in concentrations in the groundwater exceeding the requirements of the Section 16 Record of Decision and the requirements of this sitewide Record of Decision

The areas of groundwater contamination have been identified as the following:

- Subunit A plume of TCE and 1,1-dichloroethylene (1,1-DCE). This problem is being addressed in an expedited fashion as the Section 16 Operable Unit. The Operable Unit remedy is consistent with and

part of the final remedy proposed in this Record of Decision.

- Subunit B/C near the former GAC facility and the airport with TCE above ARARs. This includes some City of Goodyear wells.

- Subunit B/C west of the airport with TCE in production wells. One well in particular, the Phillips well, has exhibited TCE concentrations above ARARs.

For groundwater, the technologies were screened on their ability to satisfy the media-specific remedial response objectives:

- Protect public health and the environment from exposure to contaminated groundwater

- Eliminate further migration of contaminated groundwater

- Restore the quality of the Subunit B/C aquifer with respect to contaminant levels that can be attributed to industrial activities

SOILS

Listing of Alternatives

The soil alternatives for remedial action are:

- Excavation and treatment

- Placement of a RCRA-type multilayer clay and membrane cap and/or an asphaltic concrete cap over contaminated soils

- In-place treatment by soil vapor extraction

- No action

These alternatives were evaluated for their cost-effectiveness in meeting the remedial response objectives. A range of action levels, determined through analyzing the applicable and relevant or appropriate requirements, was also evaluated for three areas delineated by the level of soil contamination. These target areas are depicted in Figures 5-1 through 5-3.

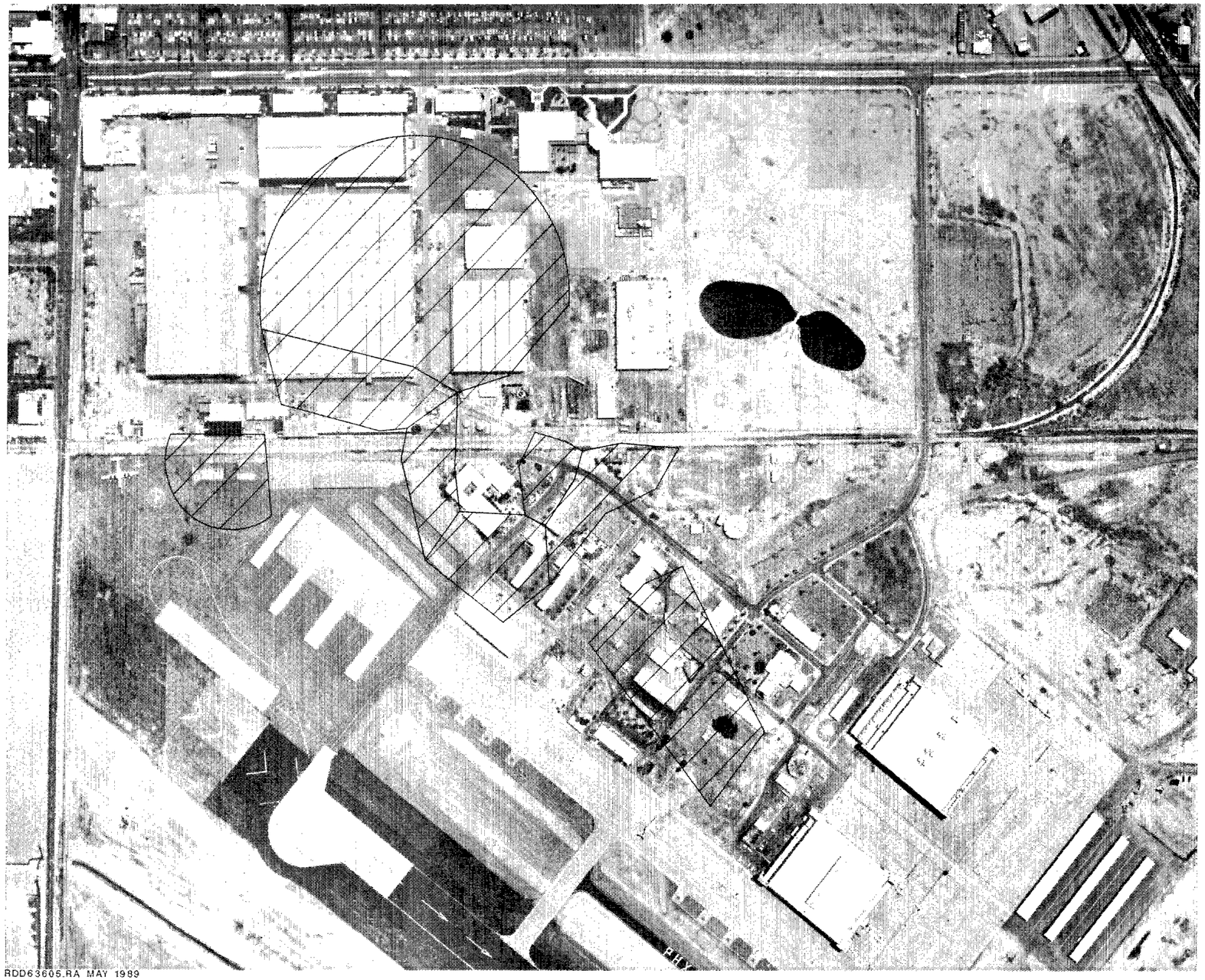

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FIGURE 5-1
TARGET AREA 1
FOR SOILS REMEDIAL ACTION
AT PHOENIX GOODYEAR AIRPORT
AND FORMER GAC FACILITIES
PHOENIX GOODYEAR AIRPORT ROD

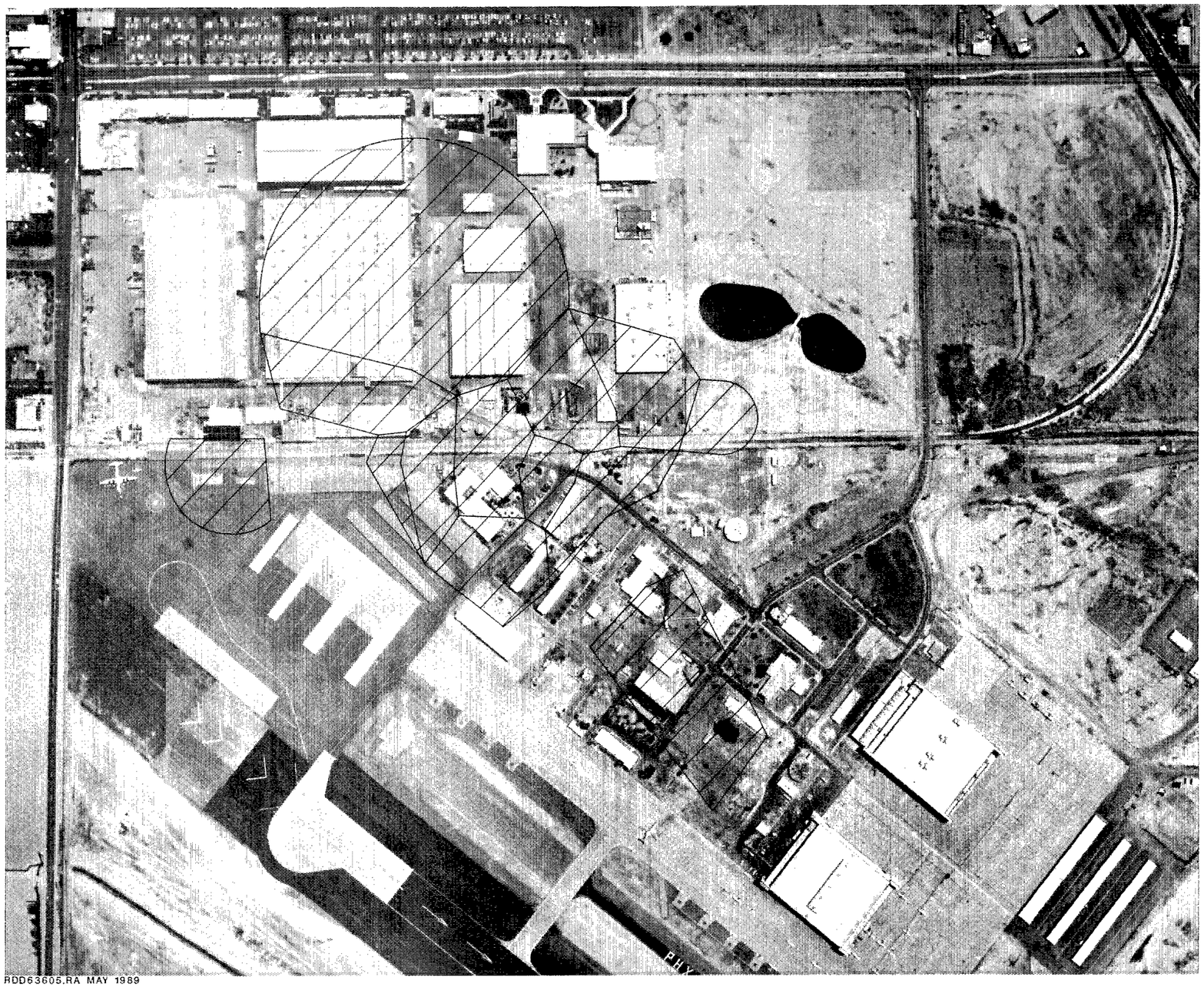

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FIGURE 5-2
TARGET AREA 2
FOR SOILS REMEDIAL ACTION
AT PHOENIX GOODYEAR AIRPORT
AND FORMER GAC FACILITIES
PHOENIX GOODYEAR AIRPORT ROD

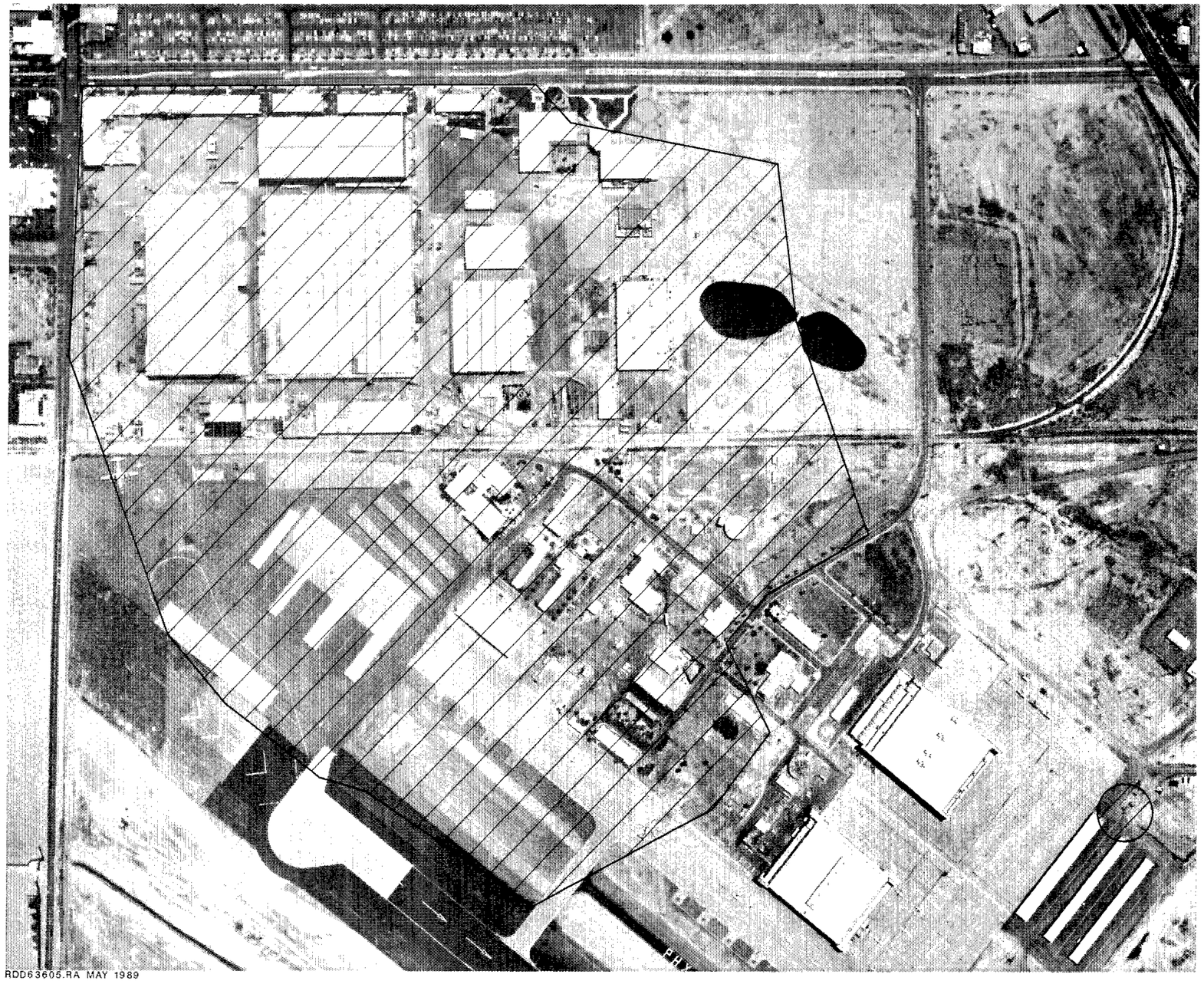

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FIGURE 5-3
TARGET AREA 3
FOR SOILS REMEDIAL ACTION
AT PHOENIX GOODYEAR AIRPORT
AND FORMER GAC FACILITIES
PHOENIX GOODYEAR AIRPORT ROD

Screening of Alternatives

As set forth by CERCLA and SARA, remedial actions are those responses to releases that are consistent with a permanent remedy to prevent or minimize the release of hazardous substances, pollutants, or contaminants so they do not migrate to cause substantial danger to present or future public health or welfare or the environment. SARA, Section 121, requires consideration of the following criteria when evaluating alternatives:

- Protectiveness of human health and the environment
- Attainment of Federal and State public health and environmental requirements
- Cost-effectiveness
- Utilization of permanent solutions through reductions in volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants
- Community acceptance
- Short-term effectiveness
- Long-term effectiveness
- Implementability
- State acceptance

SARA also mandates that the offsite transport and disposal of hazardous substances or contaminated materials without such treatment should be the least favored alternative remedial action where practicable treatment technologies are available.

Alternatives were screened based on their ability to meet the above-stated requirements and to meet the remedial response objectives for each media.

Three remedial action alternatives concerning VOC contamination in vadose zone soils at the Phoenix-Goodyear Airport and former GAC facilities were selected for further evaluation:

- Placement of a RCRA-type clay and membrane cap and/or an asphaltic concrete cap over contaminated soils
- In-place treatment by soil vapor extraction equipped with emission control devices
- No action

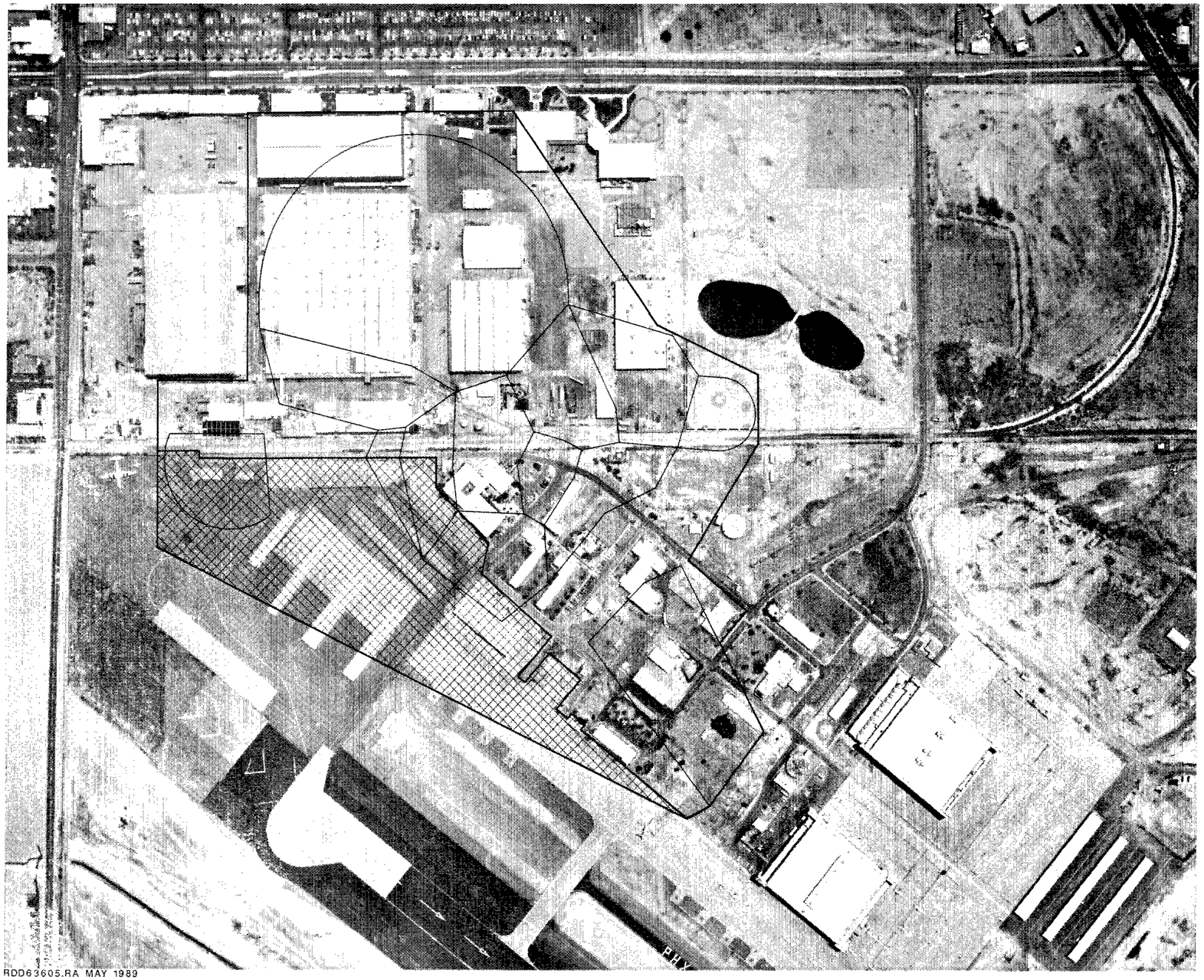
Capping. The following two areas were considered for placement of asphalt and RCRA-type multilayer caps at the airport and former GAC facilities:

- Area delineated by soil sampling results indicating elevated VOC concentrations in site soils (corresponds to Target Area 2; see Figure 5-4)
- Area delineated by soil gas sampling results indicating elevated VOC concentrations in soil gas (corresponds to Target Area 3; see Figure 5-5)

Table 5-1 presents the estimated areal quantities requiring capping based on analyses of soil gas and samples of soil at the airport and former GAC facilities.

Table 5-1
ESTIMATED CAPPING AREAS

	Area Derived from Soil Sample Analyses Showing VOC Levels Greater than Background (square yards)	Area Derived from Soil Gas Analyses (square yards)
Total area considered for capping	284,100	636,000
Estimated area occupied by existing buildings	63,000	147,100
Estimated area considered covered adequately by existing asphalt and concrete	11,800	146,500
Estimated total area considered acceptably covered	74,800	293,600
Estimated remaining area requiring coverage	209,300	342,400
Estimated area of asphalt cap required	204,700	300,500
Estimated area of RCRA-type multilayer clay-membrane cap	4,600	41,900



LEGEND

- LIMITS OF CAPPING AREA
- CLAY-MEMBRANE CAPPING OPTION
- ESTIMATED AREAS OF TCE CONTAMINATION
- AREA COVERED BY EXISTING ASPHALT OR CONCRETE PAVING

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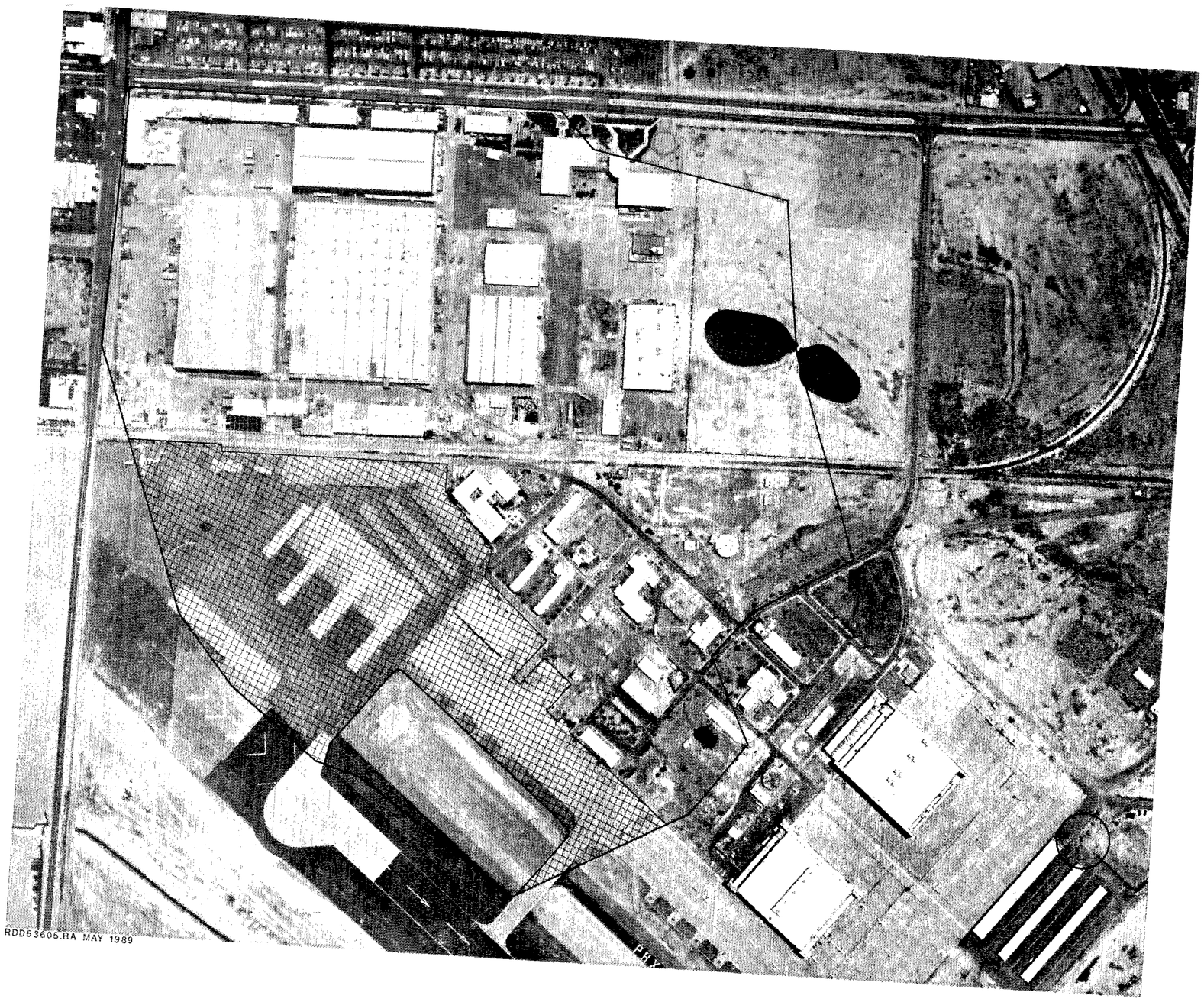
FIGURE 5-4
CAPPING ALTERNATIVE AREA DELINEATED BY SOIL SAMPLING ANALYSES AT PHOENIX GOODYEAR AIRPORT AND FORMER GAC FACILITIES
PHOENIX GOODYEAR AIRPORT ROD



LEGEND

- LIMITS OF CAPPING AREA
- CLAY-MEMBRANE CAPPING OPTION
- AREA COVERED BY EXISTING ASPHALT OR CONCRETE PAVING

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FIGURE 5-5
CAPPING ALTERNATIVE AREA DELINEATED BY ELEVATED SOIL GAS AT PHOENIX GOODYEAR AIRPORT AND FORMER GAC FACILITIES
PHOENIX GOODYEAR AIRPORT ROD

Soil Vapor Extraction. Three alternative areas are presented for implementation of a soil vapor extraction system at the airport and former GAC facilities:

- The area delineated by analyses of samples that quantify VOCs in soil in excess of Arizona Department of Health Services (ADHS) cleanup levels for soils. This area corresponds to Target Area 1.

- The area delineated by analyses of soil samples indicating VOC levels in soils greater than background. This area corresponds to Target Area 2.

- The area delineated by analyses of soil gas samples that indicate VOCs in soil gas greater than 1 µg/l. This is the concentration considered to be indicative of vadose zone contamination above background levels. This area corresponds to Target Area 3.

Experience at other sites where soil vapor extraction has been applied for removal of VOCs from contaminated soils has shown that a phased or staged approach has been effective. An extraction and treatment system is installed in the area considered to be the most heavily contaminated, such as Target Area 1, and the elements of the system are expanded as required to achieve the desired level of cleanup.

For purposes of evaluation, both immediate full-scale implementation and phased installation are included as alternatives. The full-scale system includes operation of all wells for a period of 2 years. The phased approach includes operation of only one-quarter of the wells at any one time, but extends treatment over an 8-year period.

Table 5-2 presents estimated surface areas for the alternative target areas and the estimated number of vapor extraction wells required for VOC removal from soils.

No Action. The no action alternative is presented as a basis for comparison with other alternatives for VOC contamination in vadose soils. A no action alternative may include administrative actions such as restrictions on access and deeds and monitoring of VOCs in the vadose zone at the airport and former GAC facility.

Table 5-2
ESTIMATED SURFACE AREAS AND NUMBER OF WELLS
FOR SOIL VAPOR EXTRACTION

	Total Area Considered for Implementation of Soil Vapor Extraction System (square yards)	Estimated Number of Wells Required to Provide Coverage
Soils Target Area 1	138,100	40
Soils Target Area 2	284,100	82
Soils Target Area 3	636,000	183

The screening summary for the remedial action alternatives for VOC soils contamination in the vadose zone is presented in Table 5-3.

Evaluation of Alternatives

The alternatives surviving the screening process are summarized in Table 5-4. The no action alternative does not attain the remedial action objectives. Capping or soil vapor extraction or some combination of capping and soil vapor extraction is feasible for Target Areas 2 and 3. Only soil vapor extraction is feasible for Target Area 1. While capping alone does reduce the rate of infiltration of water through contaminated vadose zone soils, it does not reduce or eliminate the VOC levels in soils and is not a permanent remedy. Combined with capping, soil vapor extraction removes the VOCs from the soil and achieves the remedial action objectives.

While some combination of capping and SVE is feasible, an alternative considering both technologies was not evaluated in the Feasibility Study. The most reasonable combination that could have been considered is capping over the most contaminated areas with SVE implemented over a larger area. The reasons that this type of alternative was not evaluated are that (1) capping over the most contaminated areas

Table 5-3
SOILS REMEDIAL ACTION SCREENING SUMMARY

Alternative	Implementability	Effectiveness	Relative Cost	Conclusions: Retain	Conclusions: Drop	Conclusions: Comments
1. No action.	N/A	N/A	N/A	X		No action is retained as a baseline case.
2. Soil vapor extraction in area defined by soil sample analyses greater than ADEQ-suggested soil action limits.	Relatively easy to install, can be staged to allow minimum disruption of surface activities.	Significantly reduces VOCs in contaminated soils.	Medium for target area	X		
3. Soil vapor extraction in area defined by soil sample analyses greater than background.	Relatively easy to install, can be staged to allow minimum disruption of surface activities.	Significantly reduces VOCs in contaminated soils.	Medium for target area	X		
4. Soil vapor extraction in area defined by soil gas analyses that quantify VOCs greater than 1 µg/l.	Relatively easy to install, can be staged to allow minimum disruption of sur face activities.	Significantly reduces VOCs in contaminated soils.	Medium for target area	X		
5. Capping of area defined by analyses of soil samples that quantify VOCs greater than ADEQ-suggested action limits.	Relatively easy to install, can be staged.	Questionable. Existing structures and paving have not affected VOC migration through soil in the past.	Low		X	Questionable effectiveness.
6. Capping of area defined by analyses of soil samples that quantify VOCs greater than background.	Relatively easy to install, can be staged.	Could be effective in retarding infiltration of water through VOC-contaminated soils.	Low	X		Difficult to determine the quantity of VOCs in soils; therefore, the effectiveness of a cap is difficult to ascertain.
7. Capping of area defined by analyses of soil gas that quantify VOCs greater than 1 µg/l.	Relatively easy to install, can be staged.	Most effective of capping options.	Low	X		See note above.

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Table 5-3
(Continued)

Alternative	Implementability	Effectiveness	Relative Cost	Conclusions		
				Retain	Drop	Comments
8. Excavation and treatment of contaminated soils in area defined by soil sample analyses that quantify VOCs in soils at concentrations greater than ADEQ-suggested action limits.	Very difficult to implement.	Eliminates VOC contamination in soils.	High		X	High cost and difficulty in implementation.
9. Excavation and treatment of contaminated soils in area defined by soil sample analyses that quantify VOCs in soil at concentrations greater than background.	Very difficult to implement.	Eliminates VOC contamination in soils.	High		X	High cost and difficulty in implementation.
10. Excavation and treatment of contaminated soils in area defined by soil gas analyses that quantify VOCs in soil at concentrations greater than 1 µg/l.	Very difficult to implement.	Eliminates VOC contamination in soil.	High		X	High cost and difficulty in implementation.

Table 5-4
SUMMARY OF SOILS REMEDIAL ACTION ALTERNATIVES

Soils Remedial Action Alternative	Technical Feasibility	Environmental Impacts	Institutional Requirements	Public Health Impacts	Reduces Toxicity, Mobility, or Volume of Contaminants
Capping	Technically feasible--some permanent O&M requirements.	Increased surface runoff.	Complies with ARARs; does not reduce, immobilize, or remove contaminants.	Reduces potential for inadvertent exposure; reduces airborne exposure.	No. Capping does reduce the rate of infiltration through contaminated soils.
Soil Vapor Extraction	Technically feasible--no permanent O&M requirements.	Air discharge of trace off-gasses.	Complies with requirements.	Reduces or eliminates VOC levels in soils.	Reduces or eliminates VOC levels in soils.
No Action	N/A	N/A	Existing	Existing conditions do not meet requirements.	N/A potential for airborne and groundwater impacts.

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(Target Area 1 or some portion of it) is not feasible due to existing structures, and (2) results of the pilot study indicate that SVE is effective without capping.

Therefore, it was concluded that a combination capping/SVE alternative would not offer any advantages above SVE alone.

Table 5-5 summarizes the costs for the soil remedial actions.

GROUNDWATER

Listing of Alternatives

A wide range of alternatives was identified for the PGA site. These alternatives were separated into three groups: groundwater extraction, water treatment, and water end use (see Figure 5-6). The potential remedial alternatives for groundwater were identified to allow the EPA to select the most cost-effective alternative. Groundwater alternatives were evaluated to compare the relative merits of containing or pumping different areas of groundwater contamination at different rates. Water end use alternatives were selected based on the feasibility of delivering water and the distance to sites capable of accepting the estimated flows.

Two target areas were defined for the PGA site based on the levels of TCE detected in Subunit B/C. Target Area 1 included the area of Subunit B/C where analyses of groundwater samples indicate VOCs including trichloroethylene (TCE) are above ARAR values. Target Area 2 is the area of Subunit B/C where analyses of groundwater samples indicate VOCs are above detection limits.

The potential remedial actions for groundwater, based on the target areas identified above and the remedial action alternatives, are:

- No action--no active remediation of groundwater. This was evaluated by considering the existing groundwater withdrawals with respect to the contaminated areas.
- Containment using either a soil-bentonite slurry wall or cement-bentonite slurry wall for each of the two target areas.
- Containment using wells to control the hydraulic gradient and reduce further migration of the

Table 5-5
SOILS REMEDIAL ACTIONS--COST SUMMARY

Alternative Technology	Target Area	Capital Cost ($)	Annual O&M Cost ($)	Present Worth 3 Percent	Present Worth 5 Percent	Present Worth 10 Percent
All asphaltic concrete cap	Target Area 2	2,081,000	62,500	4,164,000	3,331,000	2,706,000
	Target Area 3	3,301,000	102,200	6,707,000	5,341,000	4,323,000
Combined asphaltic concrete and RCRA multi-layer cap	Target Area 2	2,226,000	83,000	4,992,000	3,886,000	3,056,000
	Target Area 3	4,555,000	277,200	13,794,000	10,099,000	7,327,000
Soil vapor extraction-Full Scale	Target Area 1	1,700,000	750,000	3,135,000	3,095,000	3,002,000
	Target Area 2	3,325,000	1,100,000	5,430,000	5,370,000	5,234,000
	Target Area 3	7,248,000	1,950,000	10,979,000	10,874,000	10,632,000
Soil vapor extraction-Phased installation	Target Area 1	650,000	287,000	2,665,000	2,505,000	2,181,000
	Target Area 2	1,293,000	404,000	4,129,000	3,904,000	3,448,000
	Target Area 3	2,841,000	677,000	7,593,000	7,217,000	6,453,000
No action	N/A	N/A	N/A	N/A	N/A	N/A

Note: 1. Capital cost presented in 1988 dollars.

2. Present worth based on infinite life for capping alternatives, a 2-year life for full-scale SVE, and an 8-year life for phased SVE.

contaminants. This alternative would be applied to both target areas.

- Removal of the contamination by pumping the Sub-unit B/C aquifers until the contamination is reduced to an acceptable level. This alternative would be applied to both target areas.

Groundwater Extraction Alternatives. A range of alternatives was developed for addressing the contaminated groundwater within the above target areas. Each groundwater extraction alternative is an array of groundwater pumping wells. Existing wells are included, but all alternatives require construction of additional wells to effectively achieve hydraulic capture of the groundwater.

Two rates of removal were considered in the evaluation of groundwater extraction alternatives. The slower rate would use as many existing wells as possible and add only the wells needed to achieve a capture zone equal to the target area. The faster rate would add wells to extract the groundwater at as high a rate as practicable to accelerate the cleanup and achieve a permanent solution as soon as possible. Consequently, the range of extraction alternatives chosen for detailed analysis listed below includes increasing numbers of additional extraction wells, which affects the rate of cleanup.

The extraction alternatives chosen for detailed analyses are:

- No action--continued use of 20 existing wells to extract and contain contaminated groundwater (Groundwater Alternative 1)

- Reduction of contamination to meet ARARs--continued use of existing wells and one additional extraction well (Groundwater Alternative 3)

- Accelerated reduction of contamination to meet ARARs--continued use of existing wells and three additional extraction wells (Groundwater Alternative 4)

- Reduction of contamination to exceed ARARs--continued use of existing wells and four additional extraction wells (Groundwater Alternative 5)

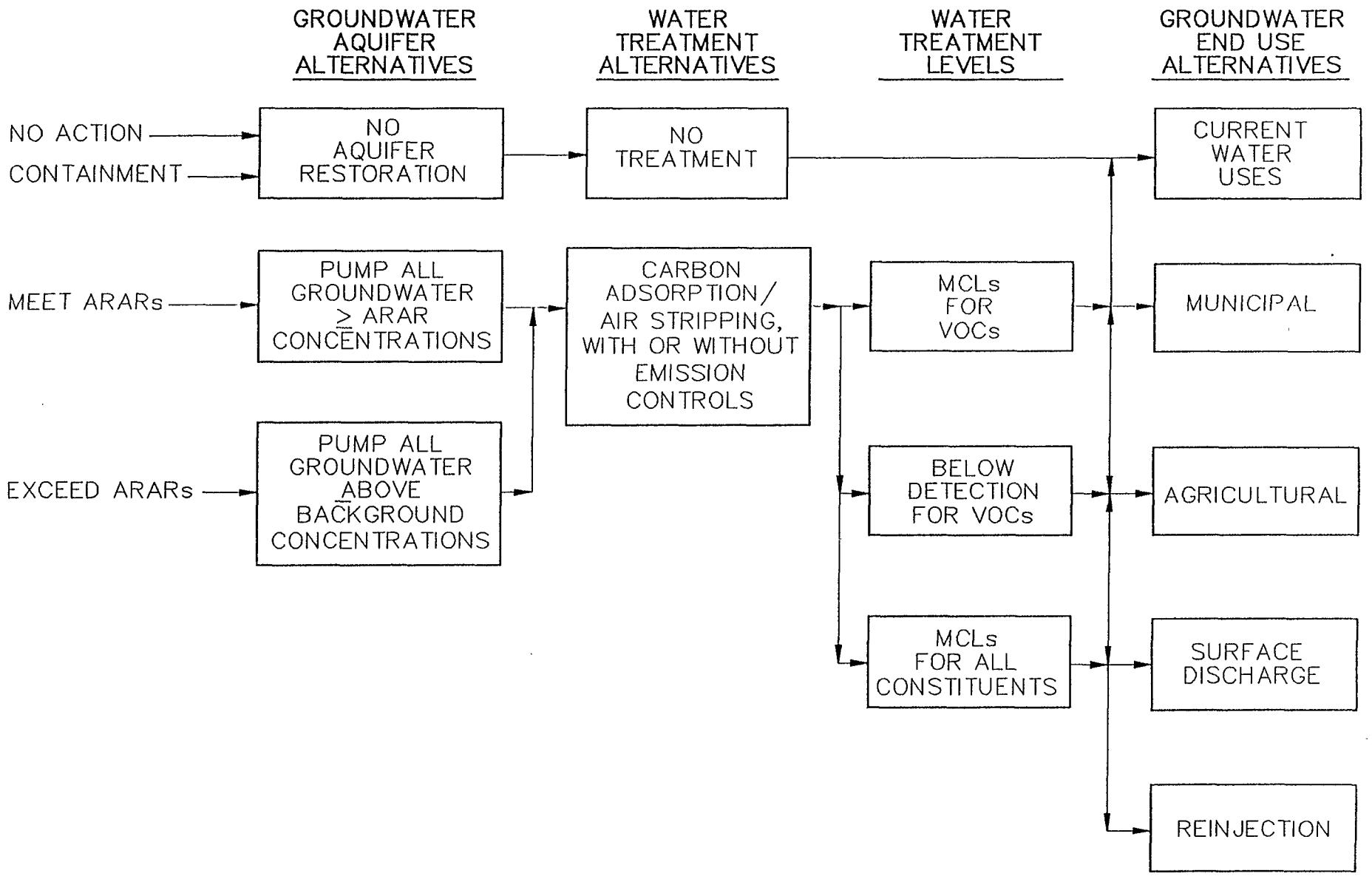

FIGURE 5-6
GROUNDWATER REMEDIAL ACTION ALTERNATIVES
PHOENIX GOODYEAR AIRPORT ROD

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- Accelerated reduction of contamination to exceed ARARs--continued use of existing wells and nine additional extraction wells (Groundwater Alternative 6)

Alternatives 5 and 6 are associated with two groundwater level-of-treatment alternatives. The groundwater level-of-treatment alternatives for Subunit B/C are:

- Removal until water from monitoring wells is of a quality that meets ARARs

- Removal until levels of VOCs in water from monitoring wells are below detection limits, which is the background quality of groundwater in the area

Water Treatment Technologies. The possible technologies identified to treat water are:

- Air stripping
- Activated carbon
- Reverse osmosis
- Distillation
- Critical fluid extraction
- Liquid-liquid extraction
- Photolysis
- Aerobic biological treatment
- Anaerobic biological treatment
- Steam treatment
- Wellhead treatment

Water End Use Alternatives. The principal objective of a water end use alternative is to provide an implementable, effective, economical, and safe means of disposal for extracted groundwater. Alternatives for water end use fall into the following basic categories:

- Agriculture--Treated water could be used for irrigation and crop production. Water may not require treatment prior to delivery to agricultural users.

- Industrial--Treated water could be used for industrial processes or washdown.

- Municipal--Treated water could be used by a municipality for domestic supply, groundwater recharge, or to satisfy water requirements or certain types of water rights.

- o Recreational--Treated water could be used for creating lakes, irrigating public parks and golf courses, and other recreational uses.

- o Reinjection--Treated water could be reinjected into the aquifer at various locations in the vicinity of the site.

- o Surface discharge--Treated water could be discharged to waste in the Agua Fria or Gila Rivers for diversion downstream for municipal or other use, or to waste in these channels.

A number of engineering constraints related to water end-use alternatives were identified, and they will affect the cost-effectiveness of the end use alternatives. A summary of engineering constraints is presented in Table 5-6. Public health and environmental considerations by water use type were also evaluated, and these are presented in Table 5-7.

Screening of Alternatives

As noted previously, under SARA and CERCLA, remedial actions are those responses to releases that are consistent with a permanent remedy to prevent or minimize the release of hazardous substances, pollutants, or contaminants so they do not migrate to cause substantial danger to present or future public health or welfare or the environment. Alternatives are screened based on their ability to meet the above-stated requirements, and those stated previously, and to meet the remedial response objectives for groundwater.

Based on the summary presented in Table 5-8, several alternatives were eliminated because they fail to satisfy the remedial response objectives. These include:

- o Construction of a containment slurry wall

- o Groundwater pumping to control migration of contaminants beyond the 5 ppb TCE boundary
- o Groundwater pumping to control migration of the contamination beyond the areas of detected TCE

Extraction Alternatives. A summary of the groundwater extraction alternatives is presented in Table 5-9. The alternative numbers correspond to those for the alternatives listed above. The alternatives were evaluated according to two criteria:

Table 5-6
SUMMARY OF ENGINEERING CONSTRAINTS
FOR WATER END USE ALTERNATIVES

Alternative	Conveyance Requirements	Physical Barriers	Hydraulic Requirements	Storage Requirements
AGRICULTURAL USE				
Buckeye Irrigation District	1 to 4 miles south, depending on source location.	Southern Pacific Railroad and State Highway 85.	None--delivery point is downhill.	None--Buckeye Canal contains waste discharge facilities.
Park Shadows Apartments	1/4 to 3 miles, depending on source location.	No significant barriers.	Pressurize to permit sprinkler irrigation. demand. Supply will likely exceed demand.	Must provide storage due to periodic
Roosevelt Irrigation District	4 to 5 miles, depending on source location.	Interstate 10.	20- to 65-foot elevation head. No pressure head required.	None--Waste capabilities currently in place.
INDUSTRIAL USE				
Loral Electronics	Varies, depending on source location.	No significant barriers.	Elevate to existing storage tank.	Supply may exceed industry's demand.
Phoenix-Goodyear Airport	Varies, depending on source location.	No significant barriers.	Elevate to storage tank. industry's demand.	Supply may exceed
Unidynamics, Inc.	Varies, depending on source location.	No significant barriers.	Elevate to storage tank. industry's demand.	Supply may exceed
RECREATIONAL USE				
Estrella Golf Course	2 to 4-1/2 miles, depending on source location.	Southern Pacific Railroad, Buckeye Irrigation District Canal, and Gila River.	Pressurize to irrigate; no elevation head.	Provide storage due to fluctuating demand.

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Table 5-6
(Continued)

Alternative	Conveyance Requirements	Physical Barriers	Hydraulic Requirements	Storage Requirements
MUNICIPAL USE				
City of Buckeye	1 to 4 miles south, depending on source location. Conveyance would be via Buckeye Canal.	Southern Pacific Railroad and State Highway 85.	None.	None--City has storage facilities.
City of Avondale	1 to 3 miles, depending on source location.	Conveyance through developed areas of Goodyear and Avondale; utility relocation, easement, coordination with cities.	Pressurize to city standard or elevate to storage tank.	Requires storage facility.
City of Litchfield Park	3 to 5 miles, depending on source location.	Interstate 10, Roosevelt Irrigation District Canal.	40 to 85 feet of elevation head, pressurize to city standard or elevate to city storage tank.	None--Existing storage facilities.
City of Goodyear	1/4 to 3 miles, depending on source location.	May require utility relocation, easement acquisition, and coordination with the city.	Pressurize water to city standard or deliver to existing storage tank.	Existing storage tank; additional storage would be required.
RECHARGE				
Reinjection or Ponding	Varies, depending on recharge points.	None anticipated.	Possible pressurization to inject to aquifer.	None anticipated.
SURFACE DRAINAGE				
Surface Discharge to Agua Fria River	Storm drain exists at site.	None.	None.	None.

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Table 5-7
PUBLIC HEALTH AND ENVIRONMENTAL CONSIDERATIONS BY WATER USE TYPE

Water Use Type	Potential Public Health Impacts	Potential Environmental Impacts
Agriculture	Incidental contact and/or ingestion of treated water by agricultural labor.	Contact and/or ingestion of treated water by livestock.
	Inhalation of volatile residual contaminants by agricultural labor or nearby residents.	Transport of residual contamination in irrigated soils.
		Transport of residual contamination to groundwater or surface-water systems.
		Uptake of residual contaminants by plants.
		Potential phytotoxicity of residual contaminants.
Industrial	Incidental contact and/or ingestion of treated water.	Possible exceedance of industrial discharge requirements to sewage treatment plants.
	Inhalation of volatile residual contaminants.	
Municipal	Direct and/or incidental contact and ingestion of treated water.	Potential phytotoxicity of residual contaminants.
	Inhalation of volatile residual contaminants.	Uptake of residual contaminants by plants, including those in residential gardens.
	Direct and/or incidental ingestion of and contact with soil irrigated with the treated water.	Transport of residual contamination in irrigated soils.
Recreational	Incidental ingestion and contact with treated water by lake users.	Potential aquatic toxicity of residual contaminants.
	Inhalation of volatile residual contaminants.	Transport of residual contamination to groundwater or surface-water systems.
		Uptake of residual contaminants by aquatic plants and organisms.
Reinjection	Incidental contact and/or ingestion of treated water. and humans.	Contact and/or ingestion of treated water by livestock
	Inhalation of volatile residual contaminants.	Potential risk to aquifers and surface-water systems.
Surface-Water Discharge	Direct and/or incidental contact and ingestion of treated water.	Potential phytotoxicity of residual contaminants.

Table 5-8
SUMMARY OF THE SCREENING OF
GROUNDWATER AQUIFER REMEDIAL ACTIONS

Alternative	Implementability	Effectiveness	Relative Cost	Conclusions: Retain	Conclusions: Drop	Conclusions: Comments
1. No action.	N/A	N/A	Low	X		No action is retained as a baseline for comparison.
2. Containment using slurry walls.	Extremely difficult installation because of depth of the middle fine-grained unit.	If properly constructed, the wall would reduce lateral migration; however, improvements in the drinking water aquifer would not occur.	High		X	High cost and relatively ineffective.
3. Groundwater pumping to meet ARAR concentrations in the aquifer. Remedial action would be applied to the target area above 5 ppb VOCs.	A groundwater extraction system would be relatively easy to construct and implement.	The ability of the system to extract contaminants is fairly certain. The duration of the remedial action is unknown.	Medium to High	X		
4. Groundwater pumping to meet ARAR concentrations in the aquifer at an accelerated rate. Remedial action would be applied to the target area above 5 ppb VOCs.	A groundwater extraction system would be relatively easy to construct and implement.	The ability of the system to extract contaminants is fairly certain. The duration of the remedial action is unknown.	Medium to High	X		
5. Groundwater pumping to exceed the ARAR concentrations in the aquifer. This alternative would be applied to the target area above background for VOCs.	A groundwater extraction system would be relatively easy to construct and implement.	This alternative would be more effective than Alternatives 3 and 4 in that a greater amount of the aquifer would be rehabilitated.	Medium to High	X		
6. Groundwater pumping to exceed the ARAR concentrations in the aquifer at an accelerated rate. This alternative would be applied to the target area above background for VOCs.	A groundwater extraction system would be relatively easy to construct and implement.	This alternative would be more effective than Alternatives 3 and 4 in that a greater amount of the aquifer would be rehabilitated.	Medium to High	X		
7. Groundwater pumping to control migration of the contaminants beyond the 5 ppb VOC boundary.	A groundwater extraction system would be relatively easy to construct and implement.	This alternative is relatively ineffective because the restoration of the drinking water aquifer is not the objective and restoration is not achieved for a very long period of time.	Medium		X	Relatively ineffective alternative.
8. Groundwater pumping to control migration of the contamination beyond the areas of detected VOCs.	A groundwater extraction system would be relatively easy to construct and implement.	This alternative is relatively ineffective because the restoration of the drinking water aquifer is not the objective and restoration is not achieved for a very long period of time.	Medium to High		X	Relatively ineffective alternative.

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Table 5-9
SUMMARY TABLE OF
GROUNDWATER EXTRACTION ALTERNATIVES

Alternative	Number of Existing Wells	Number of New Wells	Total Pumping Rate (ac-ft/yr)
1	20	0	7,463
3	20	1	8,673
4	20	3	11,093
5	20	4	12,303
6	20	9	18,353

- The ability of the selected well array to develop a hydraulic capture zone that extends throughout the target area
- The relative rate of contaminant capture by the extraction wells

Evaluation of the five Subunit B/C remedial action alternatives for the PGA site are summarized in Tables 5-10 through 5-12.

The five proposed remedial action alternatives are retained because they offer a wide range in the desirability of the factors of effectiveness, implementability, and cost. In general, effectiveness and cost factors are inversely related, while implementability factors do not vary greatly per alternative. Increasing the area of capture of contaminated groundwater and reducing the time of capture requires increased capital and operation costs.

Treatment Alternatives. Table 5-13 presents an evaluation of the technologies for VOC removal and screens out those that are not applicable. Air stripping and activated carbon adsorption were retained for detailed evaluation. The other technologies identified were dropped from further consideration for a variety of reasons including poor, variable, or unproven performance, institutional and management constraints, or inapplicability to expected contaminant concentrations. Chapter 5 of the PGA Feasibility Study provides the methodology for the screening of treatment alternatives.

Table 5-10
DETAILED ANALYSIS OF ALTERNATIVES--EFFECTIVENESS

Evaluation Criteria	Alternative 1--No Action	Alternative 3--Reduction of Contamination to Meet ARARs	Alternative 4--Accelerated Reduction of Contamination to Meet ARARs	Alternative 5--Reduction of Contamination to Exceed ARARs	Alternative 6--Accelerated Reduction of Contamination to Exceed ARARs
Short-Term Protectiveness					
Reduction of Existing Risks	No reduction of risk occurs because of lack of wellhead treatment.	Risks can be substantially reduced. Two types of risks are identified: point of use of groundwater and the zone(s) of contamination within aquifers of Subunits B/C.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
	No treatment of potentially contaminated waters is designed.	Treatment of potentially con taminated water is designed for existing and additional extraction wells.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
	Contaminants in groundwater will be reduced by capture in extraction wells. However, not all of the ARAR or back ground target volumes will be captured. Groundwater contamination will continue to spread.	Contaminants within the ARAR target area will eventually be captured in extraction wells. However, contaminants now occurring in the back ground target area will not be fully captured. Ground water contamination above background but below ARAR concentrations will continue to spread.	Contaminants within the ARAR target area will eventually be captured in extraction wells. However, contaminants now occurring in the back ground target area will not be fully captured. Ground water contamination above background but below ARAR concentrations will continue to spread.	Contaminants within the ARAR and background target area will be fully captured. The spread of groundwater contam ination outside of the back ground target area will be eliminated.	Contaminants within the ARAR and background target area will be fully captured. The spread of groundwater contam ination outside of the back ground target area will be eliminated.
Compliance with ARARs	One location-specific ARAR, the Fish and Wildlife Coordination Act (FCWA) may be potentially applicable within the PGA site. Requirements of the FWCA will likely be met.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
	Potential chemical-specific ARARs for the PGA site are listed in Table 2-5. ARARs ARARs for a number of potential contaminants are unlikely to be met at the place of use and within the groundwater target zones.	Potential chemical-specific ARARs for the PGA site are listed in Table 2-5. ARARs ARARs for potential contaminants are likely to be met at the place of use during during the remedial action and within the target zone	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.

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Table 5-10
(Continued)

Evaluation Criteria	Alternative 1-- No Action	Alternative 3-- Reduction of Contamination to Meet ARARs	Alternative 4-- Accelerated Reduction of Contamination to Meet ARARs	Alternative 5-- Reduction of Contamination to Exceed ARARs	Alternative 6-- Accelerated Reduction of Contamination to Exceed ARARs
Compliance with ARARs (continued)	A waiver from the requirements of chemical-specific ARARs is not appropriate.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Compliance with Other Criteria, Advisories, and Guidances	Requirements of criteria, advisories, and guidances are not likely to be met.	Requirements of criteria, advisories, and guidances are likely to be met.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Protection of Community During Remedial Actions	The risk to the community is at the point of use of pumped groundwaters.	The risks to the community during the remedial action may result from accidents associated with the construction operation and maintenance of the additional groundwater wells and treatment facilities.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
	Risks that remain and that cannot be readily controlled are the uncertainties associated with potential groundwater contaminants within the aquifers of Subunits B and C.	Risks that remain and that cannot be readily controlled are the uncertainties associated with potential groundwater contaminants within the aquifers of Subunits B and C.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Protection of Workers During Remedial Actions	Not applicable.	The risks to workers during the remedial action include various levels of exposure to potential contaminants and accidents during all phases of the remedial action.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
		All risks should be minimized with appropriate preparation and conscientious performance.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Time Until Protection is Achieved	Not applicable.	The time required to reduce contamination to concentration goals is not definitely known. However, it is estimated that at least 90 years of pumping will be required to reduce contaminant levels in the aquifer to below ARAR	The time required to reduce contamination to concentration goals is not definitely known. However, it is estimated that at least 38 years of pumping will be required to reduce contaminant levels in the aquifer to below ARAR	The time required to reduce contamination to concentration goals is not definitely known. However, it is estimated that at least 65 years of pumping will be required to reduce contaminant levels in the aquifer to below ARAR	The time required to reduce contamination to concentration goals is not definitely known. However, it is estimated that at least 40 years of pumping will be required to reduce contaminant levels in the aquifer to below ARAR

Table 5-10
(Continued)

Evaluation Criteria	Alternative 1--No Action	Alternative 3--Reduction of Contamination to Meet ARARs	Alternative 4--Accelerated Reduction of Contamination to Meet ARARs	Alternative 5--Reduction of Contamination to Exceed ARARs	Alternative 6--Accelerated Reduction of Contamination to Exceed ARARs
Time Until Protection is Achieved (continued)		concentrations within the ARAR target volume. This alternative is not effective in flushing the aquifer in the background target area.	concentrations within the ARAR target volume. This alternative is not effective in flushing the aquifer in the background target area.	concentrations within the ARAR target volume. It is estimated that at least 158 years of pumping will be required to reduce contaminant levels in the aquifer to below background concentrations within the background target volume.	concentrations within the ARAR target volume. It is estimated that at least 108 years of pumping will be required to reduce contaminant levels in the aquifer to below background concentrations within the background target volume.
		The time when remedial activities will commence is not known.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
		The time when remedial actions will be complete is not known.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
		The risk or magnitude of the principal threat during the remedial action should be minimal if appropriate measures are followed.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Long-Term Protectiveness					
Reduction of Future Risks	Not applicable.	The remaining sources of risk include potential groundwater contamination greater than ARAR and background concentrations both inside and outside the target cleanup areas.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
		Unknown sources of risk that may remain after the remedial action include additional undiscovered sources of groundwater pollution and migration of potentially contaminated groundwaters that escape monitoring and remediation.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.

Table 5-10
(Continued)

Evaluation Criteria	Alternative 1--No Action	Alternative 3--Reduction of Contamination to Meet ARARs	Alternative 4--Accelerated Reduction of Contamination to Meet ARARs	Alternative 5--Reduction of Contamination to Exceed ARARs	Alternative 6--Accelerated Reduction of Contamination to Exceed ARARs
Long-Term Reliability	Not applicable.	The potential for failure of the additional groundwater extraction well depends on how accurately the target cleanup area(s) define the actual spatial distribution of contamination and how completely groundwater extraction can collect groundwater contamination from within the target cleanup area(s).	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
		The magnitude of the threats or risk should remedial action fail may range from minimal to severe. Non-treated, potentially contaminated waters used for municipal and industrial purposes offer the greatest risk.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Compliance with ARARs	Not applicable.	Long-term requirements of location-specific and chemical-specific ARARs, other criteria, advisories, and guidances are likely to be met.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Prevention of Future Exposure to Residuals	Not applicable.	The likelihood of future exposure to residual contaminants is not known but may be present.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
		Should the remedial action fail, the threats or risks are likely limited to the point of use of extracted groundwater. The magnitude of these risks is not known.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Potential Need for Replacement	Not applicable.	The likelihood for needing replacement of the monitoring wells, extraction wells, and pumps is very high.	The likelihood for needing replacement of the monitoring wells, extraction wells, and pumps is very high.	The likelihood for needing replacement of the monitoring wells, extraction wells, and pumps is very high.	The likelihood for needing replacement of the monitoring wells, extraction wells, and pumps is very high.

Table 5-10
(Continued)

Evaluation Criteria	Alternative 1-- No Action	Alternative 3-- Reduction of Contamination to Meet ARARs	Alternative 4-- Accelerated Reduction of Contamination to Meet ARARs	Alternative 5-- Reduction of Contamination to Exceed ARARs	Alternative 6-- Accelerated Reduction of Contamination to Exceed ARARs
Potential Need for Replacement (continued)		The required replacement of wells is anticipated to be every 40 years, pumps every 30 years.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
		If rehabilitation of the wells occurs at regular intervals, risks associated with failure should be low.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
		Replacement of monitoring wells should not present significant risk as long as the retired wells are prop erly sealed.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Reduction of Toxicity, Mobility, or Volume					
Permanent and Significant Reduction of Toxicity, Mobility, or Volume	Treatment is not designed.	Treatment of groundwater to remove potential groundwater contaminants is an essential design of the remedial action.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
	None of the groundwater is designated for treatment.	All groundwater discharges from the additional extraction well and all operating wells within or near to either the ARAR and/or background target areas will be included in the treatment design.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
	It is not known, quantita tively, to what extent the total mass of toxic contami nation within Subunits B/C will be reduced or destroyed. Significant reduction should occur, however, during the operation of existing extrac tion wells.	It is not known, quantita tively, to what extent the total mass of toxic contami nation within Subunits B/C will be reduced or destroyed. Significant reduction should occur, however, during the operation of the remedial action.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.

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Table 5-10
(Continued)

Evaluation Criteria	Alternative 1-- No Action	Alternative 3-- Reduction of Contamination to Meet ARARs	Alternative 4-- Accelerated Reduction of Contamination to Meet ARARs	Alternative 5-- Reduction of Contamination to Exceed ARARs	Alternative 6-- Accelerated Reduction of Contamination to Exceed ARARs
Permanent and Significant Reduction of Toxicity, Mobility, or Volume (continued)	Mobility of contaminants in groundwater will be reduced by capture in extraction wells. However, not all of the ARAR or background target volumes will be captured. Groundwater contamination will continue to spread.	Contaminants within the ARAR target area will eventually be captured in extraction wells. However, contaminants now occurring in the background target area will not be fully captured. Groundwater contamination above background but below ARAR concentrations will continue to spread.	Contaminants within the ARAR target area will eventually be captured in extraction wells. However, contaminants now occurring in the background target area will not be fully captured. Groundwater contamination above background but below ARAR concentrations will continue to spread.	Contaminants within the ARAR and background target area will be fully captured. The spread of groundwater contamination outside of the background target area will be eliminated.	Contaminants within the ARAR and background target area will be fully captured. The spread of groundwater contamination outside of the background target area will be eliminated.
	This alternative is not effective in reducing concentrations to below ARARs throughout the target volume.	The time required to reduce contamination to concentration goals is not definitely known. However, it is estimated that at least 90 years of pumping will be required to reduce contaminant levels in the aquifer to below ARAR concentrations within the ARAR target volume. This alternative is not effective in flushing the aquifer in the background target area.	The time required to reduce contamination to concentration goals is not definitely known. However, it is estimated that at least 38 years of pumping will be required to reduce contaminant levels in the aquifer to below ARAR concentrations within the ARAR target volume. This alternative is not effective in flushing the aquifer in the background target area.	The time required to reduce contaimination to concentration goals is not definitely known. However, it is estimated that at least 65 years of pumping will be required to reduce contaminant levels in the aquifer to below ARAR concentrations within the ARAR target volume. It is estimated that at least 158 years of pumping will be required to reduce contaminant levels in the aquifer to below background concentrations within the background target volume.	The time required to reduce contamination to concentration goals is not definitely known. However, it is estimated that at least 40 years of pumping will be required to reduce contaminant levels in the aquifer to below ARAR concentrations within the ARAR target volume. It is estimated that at least 108 years of pumping will be required to reduce contaminant levels in the aquifer to below background concentrations within the background target volume.
	To what extent the overall threats are reduced is not known.	There will be permanent and significant reduction of Toxicity, Mobility and Volume by removing the contamination to meet ARARs.	Same as Alternative 3.	There will be permanent and significant reduction of Toxicity, Mobility and Volume by removing the contamination to exceed ARARs.	Same as Alternative 5.

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Table 5-11
DETAILED ANALYSIS OF ALTERNATIVES--IMPLEMENTABILITY

Evaluation Criteria	Alternative 1--No Action	Alternative 3--Reduction of Contamination to Meet ARARs	Alternative 4--Accelerated Reduction of Contamination to Meet ARARs	Alternative 5--Reduction of Contamination to Exceed ARARs	Alternative 6--Accelerated Reduction of Contamination to Exceed ARARs
Short-Term Technical Feasibility					
Ability to Construct Technology	Not applicable.	No serious difficulties are anticipated with construction of the extraction and monitoring wells. The unknowns related to construction are the spatial variability in lithology and potential groundwater contamination.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Short-Term Reliability of Technology	Not applicable.	The likelihood is high that groundwater extraction well and surface treatment technologies will meet required process efficiencies or performance specifications. The likelihood that technology problems will lead to schedule delays is not known.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Compliance with Some Action-Specific ARARs	Not applicable.	All action-specific ARARS are likely to be met.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Long-Term Technical Feasibility					
Ease of Undertaking Additional Remedial Action, if Necessary	Not applicable.	The likely future remedial action that may be anticipated is the need for additional extraction wells to capture potentially contaminated groundwater, both within and outside of the target cleanup areas. It should not be difficult to implement additional remedial actions if required.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.

Table 5-11
(Continued)

Evaluation Criteria	Alternative 1--No Action	Alternative 3--Reduction of Contamination to Meet ARARs	Alternative 4--Accelerated Reduction of Contamination to Meet ARARs	Alternative 5--Reduction of Contamination to Exceed ARARs	Alternative 6--Accelerated Reduction of Contamination to Exceed ARARs
Ability to Monitor Effectiveness of Remedy	Not applicable.	Migration pathways of potentially contaminated groundwater may occur along relatively narrow "shoestring" permeable units. These units may miss monitoring efforts. Exposure pathways are limited to point of use of extracted groundwater. Points of use can be easily monitored. Risk of exposure due to monitoring that is insufficient to detect failure most likely will occur downdip from the western boundaries of the target cleanup areas. Anticipated contaminant concentrations should be on the same order of magnitude as ARAR concentrations.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Ability to Perform Operation and Maintenance Functions	Not applicable.	Difficulties associated with long-term operation and maintenance include the finite design life of extraction wells, monitoring wells, pumps, and treatment facilities. Unknowns related to long-term operation and maintenance include the ability of groundwater flux to cleanse pollutants from the aquifer and the time of the working life of wells, pumps, and conveyance systems.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.

Table 5-11
(Continued)

Evaluation Criteria	Alternative 1-- No Action	Alternative 3-- Reduction of Contamination to Meet ARARs	Alternative 4-- Accelerated Reduction of Contamination to Meet ARARs	Alternative 5-- Reduction of Contamination to Exceed ARARs	Alternative 6-- Accelerated Reduction of Contamination to Exceed ARARs
Administrative Feasibility					
Ability to Obtain Approvals from Other Agencies	Not applicable.	Specific approvals from other agencies include Arizona Department of Water Resources (ADWR)--poor water quality withdrawal permit and Arizona Department of Environmental Quality (ADEQ)--concurrence with remedial actions as required by SARA. It is likely approval from agencies will be obtained.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Likelihood of Favorable Community Response	The community response is likely to be highly unfavorable to "no action." The technical basis for the highly unfavorable response is valid--possible exposure to contaminated groundwater.	The community response is likely to be mixed. It will likely be favorable to the complete cleanup of contamination above ARARs and unfavorable to the incomplete cleanup of contamination below ARARs. The technical basis for the unfavorable response may be valid.	Same as Alternative 3.	The community response is likely to be favorable to the total cleanup of contamination within the target cleanup areas. The high costs of the cleanup may be unfavorably received by the community, however.	Same as Alternative 5.
Coordination with Other Agencies	Not applicable.	Creating a plan for groundwater management of the target cleanup areas is a step that requires coordination with other agencies. Long-term or future coordination among agencies requires a designated agency to oversee the groundwater management at the site.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Compliance with Some Location-Specific ARARs	Not applicable.	All location-specific ARARs are likely to be met.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.

Table 5-11
(Continued)

Evaluation Criteria	Alternative 1-- No Action	Alternative 3-- Reduction of Contamination to Meet ARARs	Alternative 4-- Accelerated Reduction of Contamination to Meet ARARs	Alternative 5-- Reduction of Contamination to Exceed ARARs	Alternative 6-- Accelerated Reduction of Contamination to Exceed ARARs
Availability					
Availability of Treatment, Storage, and Disposal Services and Capacity	Not applicable.	Adequate treatment, storage, and disposal services and capacity are available per design. No additional capacity is necessary unless the target cleanup areas require modification.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
Availability of Necessary Equipment and Specialists	Not applicable.	The necessary equipment and specialists should be available to construct, operate, and maintain the operation of the remedial action.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.

Table 5-12
DETAILED ANALYSIS OF ALTERNATIVES--Cost

Evaluation Criteria	Alternative 1--No Action	Alternative 3--Reduction of Contamination to Meet ARARs	Alternative 4--Accelerated Reduction of Contamination to Meet ARARs	Alternative 5--Reduction of Contamination to Exceed ARARs	Alternative 6--Accelerated Reduction of Contamination to Exceed ARARs
Capital Costs					
Estimated Capital Costs for Development and Construction					
Direct Costs	Not applicable.	25 Monitoring wells at $25,000 each $625,000 1 Extraction well single casing at $39,000 39,000 Telescoped casing 0 1 Well pump at $25,000 25,000 $689,000	25 Monitoring wells at $25,000 each $625,000 3 Extraction wells single casing at $39,000 each 117,000 1 Telescoped casing at $58,000 58,000 3 Well pumps at $25,000 each 75,000 $875,000	50 Monitoring wells at $25,000 each $1,250,000 3 Extraction wells single casing at $39,000 each 117,000 1 Telescoped casing at $58,000 58,000 4 Well pumps at $25,000 each 100,000 $1,525,000	50 Monitoring wells at $25,000 each $1,250,000 9 Extraction wells single casing at $39,000 each 351,000 Telescoped casing 0 9 Well pumps at $25,000 each 225,000 $1,826,000
Indirect Costs	Not applicable.				
Other Capital and Short-Term Costs until Remedial Action is in Place	Not applicable.				
Annual Operating Costs					
Estimated Annual Costs of Operation and Maintenance for as long as Necessary					
Operating Labor	Not applicable.				
Maintenance, Materials and Labor	Not applicable.	Well and pump rehabilitation, 26 wells, $10,000/10 years/well = $260,000/10 years	Well and pump rehabilitation 10-year design, 28 wells, $10,000/well/10 years = $280,000/10 years	Well and pump rehabilitation 10-year design, 54 wells, $10,000/well/10 years = $540,000/10 years	Well and pump rehabilitation 10-year design, 59 wells, $10,000/well/10 years = $590,000/10 years

Table 5-12
(Continued)

Evaluation Criteria	Alternative 1--No Action	Alternative 3--Reduction of Contamination to Meet ARARs	Alternative 4--Accelerated Reduction of Contamination to Meet ARARs	Alternative 5--Reduction of Contamination to Exceed ARARs	Alternative 6--Accelerated Reduction of Contamination to Exceed ARARs
Annual Operating Costs (continued)					
Operation Materials and Energy	Not applicable.	Electrical power costs for pumping extraction wells, 1 extraction well: Irrigation--7.5¢/kWh, $52,500/pump; water supply--11¢/kWh, $77,000 per pump	Electrical power costs for pumping extraction wells, 3 extraction wells: Irrigation--7.5¢/kWh, $52,500/pump = $157,500; water supply--11¢/kWh, $77,000/pump = $231,000	Electrical power costs for pumping extraction wells, 4 extraction wells: Irrigation--7.5¢/kWh, $52,500/pump = $210,000; water supply--11¢/kWh, $77,000/pump = $308,000	Electrical power costs for pumping extraction wells, 9 extraction wells: Irrigation--7.5¢/kWh, $52,500/pump = $472,500; water supply--11¢/kWh, $77,000/pump = $693,000
Administration	Not applicable.	1 man-year required at $60,000/year = $60,000	1 man-year required at $60,000/year = $60,000	1 man-year required at $60,000/year = $60,000	1 man-year required at $60,000/year = $60,000
Taxes and Insurance	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Maintenance Reserve and Contingency	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Monitoring Costs					
Water Level Monitoring	Not applicable.	Monthly measurement, 4 man-days/month = $1,800/month = $21,600/year	Monthly measurement, 4 man-days/month = $1,800/month = $21,600/year	Monthly measurement, 4 man-days/month = $1,800/month = $21,600/year	Monthly measurement, 4 man-days/month = $1,800/month = $21,600/year
Water Quality Sampling	Not applicable.	Quarterly sampling, 15 man-days/quarter = $6,750/quarter = $27,000/year	Quarterly sampling, 15 man-days/quarter = $6,750/quarter = $27,000/year	Quarterly sampling, 25 man-days/quarter = $11,300/quarter = $45,000/year	Quarterly sampling, 28 man-days/quarter = $12,600/quarter = $50,400/year
Analysis of Water Quality Sampling	Not applicable.	Methods 601 and 602, 47[a] wells, 1 sample/well = $230/well = $10,800/quarter = $43,200/year	Methods 601 and 602, 49[a] wells, 1 sample/well = $230/well = $11,300/quarter = $45,100/year	Methods 601 and 602, 75[a] wells, 1 sample/well = $230/well = $17,300/quarter = $69,000/year	Methods 601 and 602, 80[a] wells, 1 sample/well = $230/well = $18,400/quarter = $73,600 year
		Yearly inorganic, 47[a] wells, 1 sample/well = $270/well = $12,700/year	Yearly inorganic, 49[a] wells, 1 sample/well = $270/well = $13,200/year	Yearly inorganic, 75[a] wells, 1 sample/well = $270/well = $20,300/year	Yearly inorganic, 80[a] wells, 1 sample/well = $270/well = $21,600/year
Replacement Costs	Not applicable.	1 Extraction well, 40-year design, $39,000/well/40 years 25 Monitoring wells, 40-year design, $25,000/well/40 years = $625,000/40 years	3 Extraction wells, 40-year design, $39,000/well/40 years = $117,000/40 years 25 Monitoring wells, 40-year design, $25,000/well/40 years = $625,000/40 years	4 Extraction wells, 40-year design, $39,000/well/40 years = $156,000/40 years 50 Monitoring wells, 40-year design, $25,000/well/40 years = $1,250,000/40 years	9 Extraction wells, 40-year design, $39,000/well/40 years = $351,000/40 years 50 Monitoring wells, 40-year design, $25,000/well/40 years = $1,250,000/40 years
		1 Pump, 30-year design, $25,000/pump/30 years	3 Pumps, 30-year design, $25,000/pump/30 years = $75,000/30 years	4 Pumps, 30-year design, $25,000/pump/30 years = $100,000/30 years	9 Pumps, 30-year design, $25,000/pump/30 years = $225,000/30 years

Table 5-12
(Continued)

Evaluation Criteria	Alternative 1--No Action	Alternative 3--Reduction of Contamination to Meet ARARs	Alternative 4--Accelerated Reduction of Contamination to Meet ARARs	Alternative 5--Reduction of Contamination to Exceed ARARs	Alternative 6--Accelerated Reduction of Contamination to Exceed ARARs
Present Worth[b]		90 YEARS OF REMEDIAL ACTION:	38 YEARS OF REMEDIAL ACTION:	65 YEARS OF REMEDIAL ACTION:	40 YEARS OF REMEDIAL ACTION:
Capital Costs	Not applicable.	$ 689,000	$ 875,000	$1,525,000	$1,826,000
Power Costs, Administration, Water Level Monitoring, Water Quality Sampling Analysis	Not applicable.	2,420,000	3,870,000	5,230,000	9,000,000
Well and Pump Rehabilitation (10 years)	Not applicable.	164,000	168,000	340,000	366,000
Well Replacement (40 years)	Not applicable.	13,300	0	28,100	32,000
Pump Replacement (30 years)	Not applicable.	1,500	4,500	6,000	13,500
Total Present Worth	Not applicable.	$3,280,000	$4,917,500	$7,130,0000	$11,200,000

[a]Includes 21 existing monitoring wells completed entirely within Subunits B and/or C.
[b]Present worth of all costs adjusted to end of year zero (10 percent annual rate).

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Table 5-13
SUMMARY OF VOC REMOVAL TECHNOLOGIES SCREENING

Process Description	State of Development	Ability to Meet Discharge Standards	Performance Record	Relative Costs		Waste Streams	Additional Comments	Retained for Further Analysis
				Capital	Operation			
Air Stripping	Commercial	Capable of VOC removal exceeding 99.9 percent	Excellent	Low	Low to moderate	Air exhaust (can be carbon treated)	Commonly used for removal of VOCs at low concentrations.	Yes
Steam Stripping	Commercial	Capable of VOC removal exceeding 99.9 percent	Excellent	Moderate	High	Small air exhaust, condensate with organics	Not typically used for this type of application; can also remove NH_3 and H_2S from wastewater.	No--not well demonstrated for removal of low concentrations of VOCs
Activated Carbon Adsorption	Commercial	Capable of VOC removal exceeding 99.9 percent	Excellent	Low	Moderate to high	Carbon containing organics requires regeneration or replacement	Relatively poor carbon utilization for treatment of streams with very low organic concentrations.	Yes--useful for vapor and aqueous phase VOC removal
Reverse Osmosis	Commercial	Relatively poor performance for VOCs	Poor for VOC removal	High	High	Produces a concentrate stream that requires additional treatment	Generally used for removal of salts and high molecular weight organics.	No--poor performance for VOC removal
Distillation	Commercial	Capable of achieving very high VOC removal	Good on high concentration streams; not appropriate for low concentration streams	Moderate	Very high	Small air exhaust, organic liquid, condensate with organics	Generally used for treatment of concentrated streams where high degree of separation is required.	No--not appropriate for low levels of contaminants
Liquid-Liquid Extraction	Limited Commercial	Unknown--polishing is usually required	Good, but ability to meet discharge requirements is unknown	High	Very high	Solvent with extracted organics	Produces a solvent stream with organics that requires additional treatment; requires use of potentially hazardous solvents; residual solvent in treated water.	No--ability to meet discharge requirements is unknown
Critical Fluid Extraction	Limited Commercial	Unknown--although unlikely to reduce below 100 ppb	Limited--few large-scale applications	Very High	Moderate to high	None	None	No--poor performance for this application
Aerobic Biological	Commercial	Some compounds not readily biodegradable	Variable performance for VOCs	High	High	Sludge produced that requires disposal	May not be stable, susceptible to shock, temperature-dependent, acclimation is important.	No--variable performance
Anaerobic Biological	Commercial	May not consistently meet standards	Variable performance for VOCs	High	High	Sludge produced	May not be stable, susceptible to shock, temperature-dependent, acclimation is important.	No--variable performance
Chemical Oxidation	Commercial	Capable of achieving very high VOC removal	Applicable to low concentrations	High	High	Co_2 plus byproducts	High power requirements, many oxidants are toxic; potential for toxic breakdown products to be formed.	No--Toxic breakdown products can be formed

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End Use Alternatives. Water end use alternatives were screened based on the evaluation of engineering constraints, statutory considerations, and public health and environmental considerations. Only one alternative, recreational end use, was eliminated. In this case, distance, physical barriers, absence of storage facilities, and seasonal demand tend to be the major disadvantages for potential end use by the only recreational user to express interest in treated water from the project, the Estrella Golf Course.

Evaluation of Alternatives

No Action Alternative. The no action alternative would allow the groundwater contamination to spread over an ever-widening area and would likely have continuing adverse environmental and health consequences. These include exposure to carcinogens and other harmful contaminants through ingestion of water and soil and inhalation of soil gas and gas released from pumped groundwater.

Extraction Alternatives. The pumping alternatives accomplish the objective of stopping migration of contaminants at the airport site. When coupled with treatment, they also will reduce the volume, mobility, and toxicity of the groundwater contaminants. Pumping to extract contaminated groundwater would prevent migration of contaminants from the chosen pumping area. This technology has been demonstrated to be successful in other areas. However, aquifer restoration estimations are based on hydrogeologic principles and regional flow characteristics. There is some uncertainty as to the time required for restoration. Analysis of water samples from monitoring wells for contaminant levels will indicate aquifer cleanup.

Operation is relatively simple and is not expected to significantly affect the alternative's reliability. It is likely that during the remedial action, some components will require maintenance or replacement. No impediments to well construction are foreseen, and no significant safety hazards are expected during construction. If pump failure occurs, there would be no short-term release of contaminants that could pose a threat to public health or the environment.

Treatment Alternatives. Both air stripping and activated carbon adsorption achieve the desired goal of reducing volume and toxicity of the groundwater contaminants sufficiently to meet the applicable and appropriate requirements and will likely exceed these requirements. Treatment of

contaminated groundwater, either by air stripping or the use of granular activated carbon, has been shown to be very effective with removals of organic contaminants often exceeding 99.9 percent. These processes are relatively predictable, and they have been used successfully at a number of CERCLA sites. Equipment is relatively easy to operate once initial adjustments have been completed. Operator training will be required. Occasional attention for adjustment, monitoring, and testing will be required. With industrial-grade components and regular preventive maintenance, process integrity should be 10 years or more. Scaling of air stripping tower internals has been a problem at some sites. A small amount of an antiscalant, such as hypochlorite, would be required to remedy this.

Numerous vendors are available to produce the process components. Conventional materials for construction are required.

All equipment items can be shop-fabricated and skid-mounted, making field erection easier. Construction of either process could be completed within 2 years. The startup period may take several days. Catastrophic failure of components is unlikely, and any threat to public health and the environment is relatively low.

The costs associated with every treatment alternative are summarized in Tables 5-14 through 5-16.

Air emission controls were considered as part of the air stripping alternative for two reasons. First, SARA states that a remedy should reduce the toxicity, mobility, and volume of contaminants. Second, the Maricopa County Air Pollution Control Board requires all new plants with air emissions to employ reasonably achievable control technology to reduce emissions and "will adequately dilute, reduce, or eliminate the discharge of air pollution to adjoining property." The following Maricopa County and ADHS standards would apply to ambient releases of VOCs from an air stripper:

	Maximum Release (lb per day)
Maricopa County	40[a]
ADHS	70

[a] A permit is required if this level is exceeded.

Table 5-14
TREATMENT SYSTEM COSTS
AIR STRIPPING

Item	Alternative 3 ARARs	4 ARARs	5 ARARs	5 Background	6 ARARs	6 Background
Treatment Level						
Capital Cost						
Site Preparation (Includes clearing, utilities, roads, fence, and foundation)	$ 57,000	$ 60,500	$ 57,000	$ 169,000	$ 60,500	$ 176,500
Air Stripping System	232,700	294,300	232,700	737,925	294,300	958,050
Startup	10,000	10,000	10,000	10,000	10,000	10,000
Direct Costs	242,700	304,300	242,700	747,925	304,300	968,500
Fee and Expenses	60,675	76,075	60,675	186,982	76,075	242,013
Engineering	80,900	101,433	80,900	249,308	101,433	322,683
Contingency	72,810	91,290	72,810	244,378	91,290	290,415
Total Capital Cost	457,085	573,098	457,085	1,408,592	573,098	1,823,161
Operating Cost						
Power	18,716	38,823	18,716	74,478	38,823	124,700
Labor	14,560	14,560	14,560	43,680	14,560	43,680
Maintenance	12,135	15,215	12,135	37,396	15,215	48,403
Other (Includes analytical, insurance, and administration)	18,571	19,731	18,571	56,086	19,731	60,232
Contingency	19,195	26,499	19,195	63,492	26,499	83,104
Total Operating Cost	83,176	114,827	83,176	275,133	114,827	360,118
Demobilization	24,270	30,430	24,270	74,793	30,430	96,805
Project Present Worth[a]	1,502,792	2,015,569	1,502,792	4,865,541	2,015,569	6,347,514

[a]Present worth is calculated assuming a 20-year period and a 5 percent rate of return.

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Table 5-15
TREATMENT SYSTEM COSTS
ACTIVATED CARBON

	Alternative					
	3	4	5	5	6	6
Treatment Level:	ARARs	ARARs	ARARs	Background	ARARs	Background
Item						
Capital Cost	$ 90,500	$ 102,500	$ 90,500	$ 267,000	$ 102,500	$ 295,000
Site Preparation (Includes clearing, utilities, roads, fence, and foundation)						
Activated Carbon System	1,196,121	2,034,057	1,196,121	4,156,067	2,034,057	5,937,784
Startup	10,000	10,000	10,000	10,000	10,000	10,000
Direct Costs	1,206,121	2,044,057	1,206,121	4,166,067	2,044,057	5,947,784
Fee and Expenses	301,530	511,015	301,530	1,041,517	511,015	1,486,946
Engineering	398,020	674,539	398,020	1,374,802	674,539	1,962,769
Contingency	361,836	613,217	361,836	1,249,820	613,217	1,784,335
Total Capital Cost	2,267,508	3,842,828	2,267,508	7,832,207	3,842,828	11,181,835
Operating Cost						
Carbon Replacement	124,565	232,392	125,871	473,473	241,304	739,285
Labor	18,200	18,200	18,200	54,600	18,200	54,600
Power	17,273	35,820	17,273	68,722	35,820	115,077
Maintenance	36,184	61,322	36,184	124,982	61,322	178,434
Other (Includes analytical, insurance, and administration)	36,675	52,428	36,675	120,322	52,428	153,818
Contingency	69,869	120,049	70,261	252,630	122,722	372,364
Total Operating Cost	302,766	520,211	304,464	1,094,729	531,796	1,613,578
Demobilization	120,612	204,406	120,612	416,607	204,406	594,778
Project Present Worth[a]	6,086,098	10,402,850	6,107,262	21,631,969	10,547,225	31,514,744

[a]Present worth is calculated assuming a 20-year period and a 5 percent rate of return.

Table 5-16
TOTAL TREATMENT COSTS

Item	Alternative 3 ARARs	4 ARARs	5 ARARs	5 Background	6 ARARs	6 Background
Treatment Level:						
Air Stripping						
Pipeline Cost						
Present Worth	$1,517,794	$ 2,267,102	$ 764,000	$ 3,774,393	$ 2,367,137	$ 5,653,202
Treatment System						
Cost Present Worth	1,502,792	2,015,569	1,502,792	4,865,541	2,015,569	6,347,514
Total Cost						
Present Worth	3,020,586	4,282,671	2,266,792	8,639,934	4,382,706	12,000,716
Activated Carbon						
Pipeline Cost						
Present Worth	1,517,794	2,267,102	764,000	3,774,393	2,367,137	5,653,202
Treatment System Cost						
Present Worth	6,086,098	10,402,850	6,107,262	21,631,969	10,547,225	31,514,744
Total Cost						
Present Worth	7,603,892	12,669,952	6,871,262	25,406,362	12,914,362	37,167,946

Note: All present worth costs assume a 20-year period and a 5 percent rate of return.

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Currently, Maricopa County is considering lowering its standard to 2 pounds per day. In addition, EPA has established guidance on the control of air emissions from air strippers used at Superfund sites. This guidance suggests the adoption of emission controls at sites located in nonattainment areas, even if they are not mandated by Federal or State laws and regulations or indicated by a cancer risk analysis. A nonattainment area is an area that does not meet the National Ambient Air Quality Standards for ozone. The EPA guidance suggests that sources most in need of controls are those with an actual emission rate of 15 pounds per day or more.

For all the alternatives considered here for Subunit B/C, the VOC air emissions are estimated at 1 pound per day or lower Concentrations of VOCs in the air would be difficult to measure without sophisticated air monitoring equipment. The cost of installing an air emission control unit on the air stripper will increase the project costs by two to three times that of the air stripper alone. Considering all regulations and guidance, the low emission rate from the air strippers will have a negligible effect on air quality or public health. Therefore, air emission controls have been deleted from the design of the air stripping equipment because they provide little benefit for the cost involved. This requirement may change in the future.

End Use Alternatives. A number of end use alternatives are considered feasible based on the evaluation conducted in the Feasibility Study. These include:

- Delivery of treated water to nearby municipalities
- Reinjection of treated water
- Delivery of treated water to irrigation or surface water

End use alternatives for treated groundwater must be consistent with ADWR Active Management Area plans and goals.

Table 5-17 presents a summary of cost estimates for the various extraction quantities and distribution options considered in the evaluation of water end use alternatives.

The City of Goodyear was chosen as the primary recipient of treated water because of its proximity to the site and the fact that the water extracted from the contaminated B/C aquifer will be in Goodyear's use area. Water utilized by

Table 5-17
END USE ALTERNATIVES
COST SUMMARY

Extraction and Treatment Alternative	Alternative Extraction Target Area	Alternative Distribution	Total Capital Cost ($)	Annual Operation and Maintenance Cost ($)			Present Worth of Operation and Maintenance ($)			Total Project Cost ($)		
				3%	5%	10%	3%	5%	10%	3%	5%	10%
3. Reduction of VOC Contamination to Meet ARARs	Contamination greater than ARARs	City of Goodyear	1,895,000	133,000	133,000	131,000	2,613,000	2,040,000	1,059,000	4,508,000	3,935,000	2,954,000
		96-inch Storm Drain	414,000	22,000	22,000	22,000	429,000	335,000	174,000	842,000	748,000	587,000
		Roosevelt Irrigation District	4,633,000	249,000	248,000	246,000	4,886,000	3,814,000	1,981,000	9,519,000	8,447,000	6,614,000
		Buckeye Irrigation District Main Canal	3,111,000	78,000	78,000	77,000	1,532,000	1,196,000	621,000	4,642,000	4,307,000	3,732,000
		Reinjection (east)	3,794,000	230,000	229,000	227,000	4,500,000	3,517,000	1,831,000	8,293,000	7,311,000	5,625,000
		Reinjection (west)	4,229,000	250,000	249,000	247,000	4,900,000	3,830,000	1,993,000	9,129,000	8,059,000	6,222,000
4. Accelerated Reduction of Contamination to Meet ARARs	Contamination greater than ARARs	City of Goodyear	2,196,000	158,000	157,000	156,000	3,095,000	2,416,000	1,254,000	5,290,000	4,612,000	3,450,000
		96-Inch Storm Drain	270,000	26,000	26,000	26,000	510,000	398,000	207,000	779,000	668,000	476,000
		Roosevelt Irrigation District	5,313,000	289,000	287,000	285,000	5,659,000	4,418,000	2,294,000	10,972,000	9,731,000	7,607,000
		Buckeye Irrigation District Main Canal	3,468,000	73,000	73,000	72,000	1,432,000	1,119,000	581,000	4,900,000	4,587,000	4,049,000
		Reinjection (east)	4,311,000	249,000	248,000	246,000	4,875,000	3,810,000	1,983,000	9,186,000	8,121,000	6,294,000
		Reinjection (west)	4,786,000	268,000	267,000	265,000	5,247,000	4,101,000	2,134,000	10,033,000	8,887,000	6,920,000
5. Reduction of VOC Contamination to Exceed ARARS	Contamination greater than background	City of Goodyear	2,341,000	178,000	177,000	175,000	3,480,000	2,716,000	1,410,000	5,820,000	5,057,000	3,751,000
		96-inch Storm Drain	290,000	27,000	27,000	26,000	526,000	411,000	213,000	816,000	700,000	503,000
		Roosevelt Irrigation District	5,677,000	268,000	266,000	264,000	5,246,000	4,096,000	2,127,000	10,924,000	9,774,000	7,804,000
		Buckeye Irrigation District Main Canal	3,655,000	35,000	35,000	35,000	695,000	543,000	283,000	4,350,000	4,199,000	3,938,000
		Reinjection (east)	4,585,000	222,000	221,000	220,000	4,352,000	3,402,000	1,771,000	8,937,000	7,988,000	6,357,000
		Reinjection (west)	5,053,000	231,000	230,000	229,000	4,529,000	3,541,000	1,843,000	9,582,000	8,594,000	6,897,000

Table 5-17
(Continued)

Extraction and Treatment Alternative	Alternative Extraction Target Area	Alternative Distribution	Total Capital Cost ($)	Annual Operation and Maintenance Cost ($)			Present Worth of Operation and Maintenance ($)			Total Project Cost ($)		
				3%	5%	10%	3%	5%	10%	3%	5%	10%
6. Accelerated Reduction of VOC Contamination to Exceed ARARs	Contamination greater than background	City of Goodyear	2,414,000	193,000	192,000	190,000	3,781,000	2,953,000	1,534,000	6,195,000	5,367,000	3,948,000
		96-inch Storm Drain	384,000	42,000	41,000	41,000	816,000	637,000	331,000	1,200,000	1,021,000	714,000
		Roosevelt Irrigation District	7,047,000	438,000	436,000	432,000	8,577,000	6,696,000	3,477,000	15,623,000	13,743,000	10,523,000
		Buckeye Irrigation District Main Canal	4,310,000	86,000	86,000	85,000	1,692,000	1,322,000	687,000	6,002,000	5,631,000	4,997,000
		Reinjection (east)	5,604,000	337,000	336,000	334,000	6,613,000	5,167,000	2,687,000	12,216,000	10,771,000	8,291,000
		Reinjection (west)	6,192,000	360,000	358,000	356,000	7,052,000	5,510,000	2,866,000	13,244,000	11,702,000	9,057,000

the City of Goodyear will need to be treated to drinking water standards.

UNIDYNAMICS PHOENIX, INC., FACILITY

SOILS

Listing of Alternatives

A wide range of technologies was identified for VOC-contaminated soil and groundwater for the UniDynamics Phoenix, Inc. (UPI) facility. For soil, the technologies were screened to identify alternatives that would prevent migration of TCE to subunit A and, if necessary, to preserve uses of Subunit C groundwater. For groundwater, the technologies were screened to identify alternatives that would preserve the current uses of Subunit C groundwater and protect future uses.

Various processes were combined to form a range of reasonable treatment options to meet the soil objective. The remedial alternatives to be evaluated for soils are:

- No action
- Containment through the construction of a cap
- Collection and onsite treatment
- Partial removal and treatment/disposal

The selected processes were assembled into options that would satisfy the specific objectives for the UPI site. The options represent combinations, either singly or jointly, of the general response actions and their selected representative processes. These alternatives were evaluated based on effectiveness and implementability; cost was also evaluated but to a lesser extent than other parameters. A range of action levels, determined through analyzing the applicable and relevant or appropriate requirements, was also evaluated for three areas delineated by the level of soil contamination:

- Target Area A is the area where analyses of soil samples collected identified levels of TCE or other VOCs significantly in excess of ADHS-suggested health-based cleanup levels for soil contaminants.

- Target Area B is the area in which analyses of soil samples identified VOC contamination above background levels in vadose zone soils.

- Target Area C is defined by soil gas analyses that quantified VOCs in soil gas in concentrations greater than 1 µg/l.

Target Areas A, B, and C appear on Figure 5-7.

The evaluation process is summarized in Table 5-18. The resulting potential remedial action alternatives considered for screening were:

- No action

- Removal by excavation and treatment of soils in Target Area A, B, or C

- Soil vapor extraction of VOCs with vapor phase carbon treatment applied in Target Area A, B, or C

Screening of Alternatives

Alternatives were screened based on their ability to meet the above-stated requirements and to meet the remedial response objectives for each media.

Based on the screening of the above-mentioned alternatives, the option for excavation and onsite treatment was originally eliminated based on implementability, effectiveness, and cost factors. However, this alternative may be necessary for effective removal of soil contaminated with methyl ethyl ketone (MEK) and acetone since soil vapor extraction is not effective for those contaminants. Therefore, EPA requested UniDynamics retain the excavation technology for use in alternatives to address the MEK and acetone contamination. The remaining alternatives are:

- No action

- Soil vapor extraction with vapor phase carbon for Target Area A, B, or C

- Excavation and incineration for Target Area A, B, or C

A cost summary for the target areas is presented in Table 5-19.

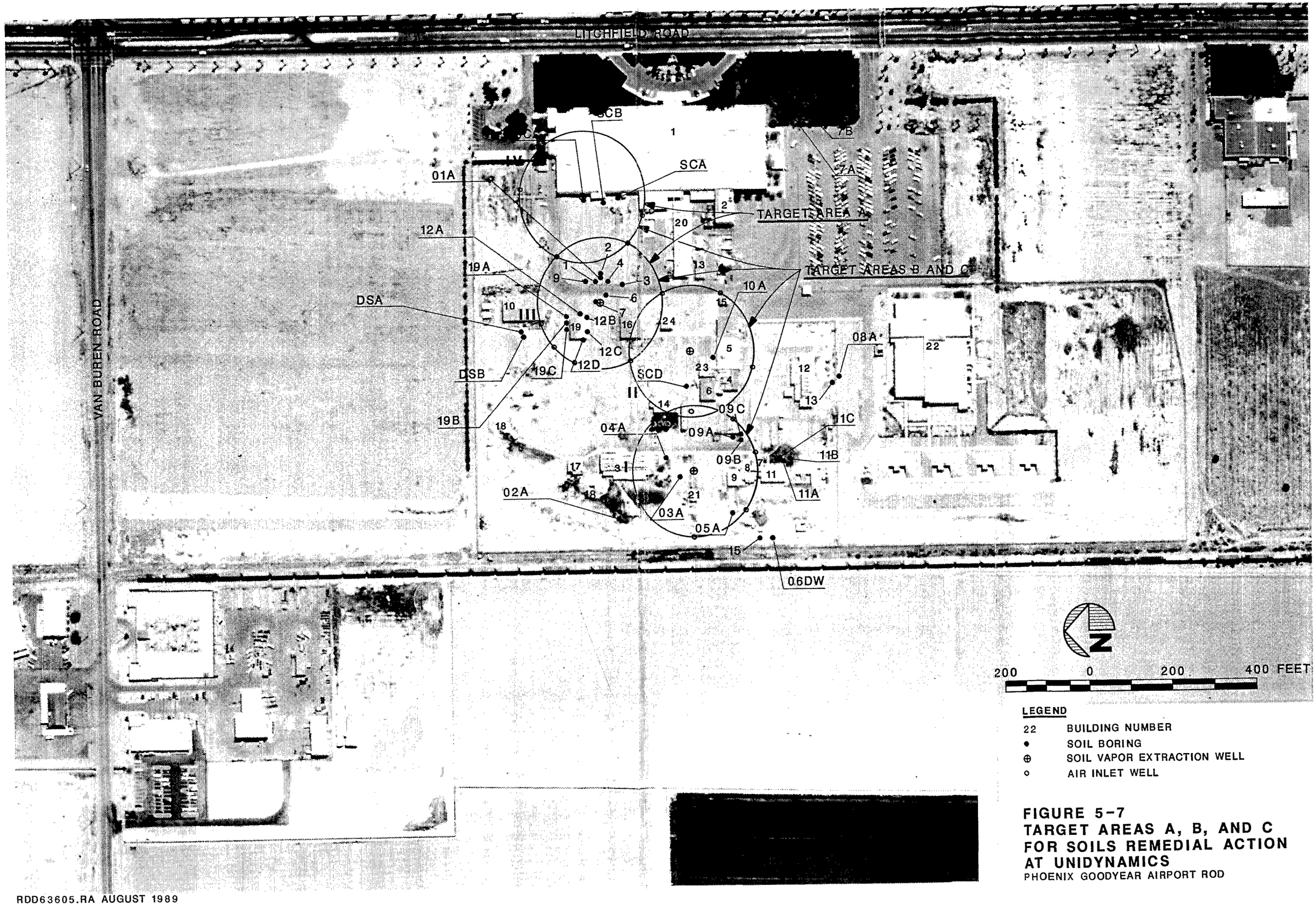

FIGURE 5-7
TARGET AREAS A, B, AND C FOR SOILS REMEDIAL ACTION AT UNIDYNAMICS
PHOENIX GOODYEAR AIRPORT ROD

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Table 5-18

TECHNICAL FEASIBILITY SCREENING OF TECHNOLOGIES AND PROCESSES FOR THE SOILS OBJECTIVE

General Response Action	Technology	Process	Feasibility Screening Comments
No Action			
No Action	Monitoring, institutional controls		Required by NCP
Containment			
Containment to minimize migration of contaminants into groundwater	Capping	Soil cap	Potentially feasible
		Soil cap with synthetic membrane	Potentially feasible
		Asphalt cap	Potentially feasible
		Concrete cap	Potentially feasible
Collection and Onsite Treatment			
Collection of volatiles	Soil vacuum extraction	Soil vacuum extraction	Potentially feasible
Treatment of volatiles	Physical treatment	Carbon adsorption	Potentially feasible
	Thermal treatment	Incineration, catalytic incineration	Not feasible, inefficient for low (ppm) concentrations of organics. Poor for chlorinated organics, requires further treatment.

Table 5-18
(Continued)

General Response Action	Technology	Process	Feasibility Screening Comments
Partial Removal and Treatment/Disposal			
Partial removal and offsite disposal of contaminated soils	Excavation	Excavation	Potentially feasible
		Drilled excavation	Potentially feasible
Partial removal and onsite treatment and disposal of contaminated soil	Transport	Transportation equipment	Potentially feasible
	Hazardous waste disposal facility	Incineration	Potentially feasible

Table 5-19
SOILS REMEDIAL ACTIONS--COST SUMMARY

Alternative Technology	Target Area	Capital Cost ($)	Annual O&M Cost ($)	O&M Present Worth 5 Percent	Total Present Worth 5 Percent
Soil Vapor Extraction	Target Area A	529,700	75,000	299,500	829,200
	Target Area B	1,051,200	110,000	516,600	1,567,800
	Target Area C	1,051,200	110,000	516,600	1,567,800

Evaluation of Alternatives. The summary of the technical evaluation for the remedial action alternatives for VOC soils contamination in the vadose zone is presented in Table 5-20. Target Areas B and C overlap; consequently, these target areas were combined in the evaluation. Although not presented, excavation may be required for MEK- and acetone-contaminated soils. Additional field investigation will be conducted during and after soils remedial actions to determine the extent of MEK and acetone-contaminated soils requiring excavation and treatment.

GROUNDWATER

Listing of Alternatives

A wide range of alternatives was identified for the UPI portion of the PGA site. The general process and technology options were identified in part based on their potential application to the specific objectives for groundwater at the UPI site. These remedial response actions were:

- No action
- Limited action
- Containment
- Pumping and onsite treatment

Initial screening of the technologies and process options was based on technical implementability or feasibility. Entire technologies and individual process options were eliminated from further consideration if they could not be implemented because of physical constraints at the site, chemical characteristics, or if their implementation could potentially result in a greater risk to human health and the environment than presently exists.

Five groundwater target volumes were evaluated for each alternative:

- Capture and treatment of TCE in Subunit A that exceeds 100 ppb
- Capture and treatment of TCE in Subunit A that exceeds Maximum Contaminant Levels (MCLs)
- Capture and treatment of TCE in Subunit A that exceeds background concentrations
- Capture and treatment of TCE in Subunit C that exceeds MCLs
- Capture and treatment of TCE in Subunit C that exceeds background

Groundwater options were combined to give a range of management and treatment options consistent with the groundwater objectives. Table 5-21 presents a summary of the technical feasibility of technologies and processes for the groundwater quality objective. The groundwater options were assembled from representative processes as follows:

1. No action
2. Groundwater extraction from Subunit A, treatment that exceeds MCLs by air stripping with vapor phase carbon, granular activated carbon polishing, and reinjection to Subunit A
3. Groundwater extraction from Subunit A at a higher rate than Option 2, treatment that exceeds background concentrations by air stripping with vapor phase carbon, granular activated carbon polishing, and discharge to Subunit A by reinjection
4. Groundwater extraction from Subunit C, treatment that exceeds MCLs by air stripping, granular activated carbon polishing, and discharge to Subunit C by reinjection or incorporation of treated water into the potable water supply

Table 5-20
EVALUATION OF SOIL OPTIONS

	Excavation Target Area A	Excavation Target Areas B & C	SVE Target Area A	SVE Target Areas B & C
Details of Options	Excavation of soil at Waste Facility No. 1 and Solvent Collection Areas A, B, and C, where sample analyses are greater than ADHS draft soil action levels.	Excavation of soil within Target Area A plus excavation at Solvent Collection Area D; Waste Facility No. 4; Waste Facility No. 10; and Waste Facility No. 12; where sample analyses are greater than background and/or soil gas is greater than 1 µg/l.	Installation at SVE network in Target Area A where sample analyses are greater than ADHS draft soil action levels.	Installation of SVE network in Target Areas B & C where sample analyses are greater than background and/or 1 µg/l soil gas.
	Treatment of contaminated soils onsite via the use of rotary kilns.	Treatment of contaiminated soils onsite via the use of rotary kilns.	Treatment by soil vacuum extraction and vapor phase carbon.	Treatment by soil vacuum and vapor phase carbon in southern two areas only.
	Import of soil for backfill of excavated areas.	Import of soil for backfill of excavated areas.		
Community Acceptance	Unknown.	Unknown.	Unknown.	Unknown.
Short-term Effectiveness Protectiveness	Short-term environmental impacts via contaminated dust problems may be difficult to control.	Short-term environmental impacts via contaminated dust problems may be difficult to control.	Short-term environmental impacts are minimal.	Short-term environmental impacts safety issues in Areas B & C.
	Construction complete within 1 year.	Construction complete within 1 year.	Construction complete within 6 months.	Construction complete within 6 months.
	Contaminated soil removed and treated with 1 year.	Contaminated soil removed and treated within 1 year.	Soil contamination remediated in approximately 3 to 5 years.	Soil contamination remediated in approximately 3 to 5 years.
	Workers would need to be protected during construction and implementation.	Workers would need to be protected during construction and implementation.	Workers are protected during construction and implementation.	Workers are protected during construction and implementation.

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Table 5-20
(Continued)

	Excavation Target Area A	Excavation Target Areas B & C	SVE Target Area A	SVE Target Areas B & C
Implementability	Conventional excavation equipment and methodology.	Conventional excavation equipment and methodology.	Conventional technology for soil vacuum extraction, collection, and treatment.	Conventional technology for soil vacuum extraction, collection, and treatment.
	Would require tie-back wall at Solvent Collection Areas A, B and C.	Would require tie-back wall at Solvent Collection Areas A, B and C.		
	Safety procedures would be difficult to implement.	Would require some demolition and facility relocation.		
		May require disruption of certain explosive and propellant operations.	May require disruption of certain explosive and propellant operations.	May require disruption of certain explosive and propellant operations.
		Safety procedures would be difficult to implement.		
	Adequate work force and equipment available.	Adequate work force and equipment available.	Adequate work force and equipment available.	Adequate work force and equipment available.
	Difficult to implement without moderate disruption to facility activities.	Difficult to implement without severe disruption to facility activities.	Moderate disruption to facility activities.	Severe disruption to facility activities.
				Safety requirements may be difficult to implement.
			Requires periodic monitoring.	Requires periodic monitoring.
Reduction of Toxicity, Mobility, or Volume	Soil excavation to reduce mobility or migration of contaminants within soil.	Soil excavation to reduce mobility or migration of contaminants within soil.	SVE treatment uses collection by soil vacuum extraction to reduce mobility of contaminants.	SVE treatment uses collection by soil vacuum extraction to reduce mobility of contaminants.
	Reduces toxicity and volume of contaminated soil by treatment using onsite incineration.	Reduces toxicity and volume of contaminated soil by treatment using onsite incineration.	Reduces toxicity and volume of contaminants by activated carbon treatment.	Reduces toxicity and volume of contaminants by activated carbon treatment.

Table 5-20
(Continued)

	Excavation Target Area A	Excavation Target Areas B & C	SVE Target Area A	SVE Target Areas B & C
Reduction of Toxicity, Mobility, or Volume (Continued)	Reduces toxicity and volume of residual contaminants by disposal at a TSD facility.	Reduces toxicity and volume of residual contaminants by disposal at a TSD facility.		
	A calculated 23,200 pounds of TCE and other volatile organics currently estimated to be present is to be removed from the excavated areas in 2 years.	A calculated 23,200 pounds of TCE and other volatile organics currently estimated to be present is to be removed from the excavated areas in 2 years.		
	May increase VOC contamination in atmosphere via fugitive dust problems.	May increase VOC contamination in atmosphere via fugitive dust problems.	Up to the calculated 23,200 pounds of TCE and other volatile organics currently estimated to be present would be removed from the soil over a 5-year treatment period.	Up to the calculated 23,200 pounds of TCE and other volatile organics currently estimated to be present would be removed from the soil over a 5-year treatment period.
	May increase short-term exposure of community and workers via atmospheric transport of VOCs.	May increase short-term exposure of community and workers via atmospheric transport of VOCs.		
Overall Protection of Human Health and the Environment	Short-term risks are high with potential for atmospheric contamination by VOCs in dust.	Short-term risks are high with potential for atmospheric contamination by VOCs in dust.	Short-term risks are low with relatively short implementation times for treatment and protection of community and workers.	Short-term risks are low with relatively short implementation times for treatment and protection of community and workers.
	Risks are reduced, and long-term permanent effectiveness is achieved. However, target levels may be in excess of required level of cleanup. To that extent there would be no further risk reduction.	Risks are reduced, and long-term permanent effectiveness is achieved. However, target levels may be in excess of required level of cleanup. To that extent there would be no further risk reduction.	Risks are reduced, and long-term permanent effectiveness is achieved. However, target levels may be in excess of required level of cleanup. To that extent there would be no further risk reduction.	Risks are reduced, and long-term permanent effectiveness is achieved. However, target levels may be in excess of required level of cleanup. To that extent there would be no further risk reduction.

Table 5-20
(Continued)

	Excavation Target Area A	Excavation Target Areas B & C	SVE Target Area A	SVE Target Areas B & C
Overall Protection of Human Health and the Environment (Continued)	Does not conform to preference for avoiding land disposal.	Does not conform to preference for avoiding land disposal.		
	There are no ARARs for soil cleanup.	There are no ARARs for soil cleanup.	There are no ARARs for soil cleanup.	There are no ARARs for soil cleanup.
State Acceptance	Approval from agencies uncertain.	Approval from agencies uncertain.	Approval from agencies uncertain.	Approval from agencies uncertain.
COSTS	$21,776,500	$40,328,150	$529,700	$2,102,400
Capital Costs				
Annual Costs	--	--	$ 75,000	$ 220,000
Present Worth Costs	$21,776,500	$40,328,150	$829,200	$3,135,600
Long-term Effectiveness and Permanence	No risk remains at conclusion of remedial activities.	No risk remains at conclusion of remedial activities.	No risk remains at conclusion of remedial activities.	No risk remains at conclusion of remedial activities.
	Conventional technology with proven results.	Conventional technology with proven results.	Conventional technology with proven results.	Conventional technology with proven results.

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Table 5-21
TECHNICAL FEASIBILITY SCREENING OF TECHNOLOGIES
AND PROCESSES FOR THE GROUNDWATER QUALITY OBJECTIVE

General Response Action	Technology	Process	Feasibility Screening Comments
No Action			
No Action	Monitoring	Monitoring, institutional controls	Required by NCP
Limited Action	Point of use wellhead	Treatment at drinking water production wells	Potentially feasible
Containment			
Containment to prevent migration of contaminated groundwater	Vertical barrier	Slurry wall	Potentially feasible
		Steel sheet pile wall	Not feasible for depths required
		Grout wall	Not feasible for depths required
Pumping and Onsite Treatment at a Central Treatment Facility			
Pumping, onsite treatment and discharge	Groundwater pumping	Production wells	Potentially feasible
	Physical-chemical treatment	Air stripping	Potentially feasible
		Steam stripping	Potentially feasible
		Carbon adsorption	Potentially feasible
		Reverse osmosis, ion exchange, vapor compression evaporation	Not feasible for organics; potentially feasible for inorganics

Table 5-21
(Continued)

General Response Action	Technology	Process	Feasibility Screening Comments
Pumping and Onsite Treatment at a Central Treatment Facility (continued)			
		UV-oxidation	Potentially feasible
	Biological treatment	Biological treatment	Not feasible; incompatible for waste types encountered
	In situ treatment	Enhanced bioreclamation	Not feasible; incompatible for chlorinated organics
		Chemical oxidation	Not feasible; undemonstrated with potential for adverse effects
	Discharge		
	Discharge to aquifer	Injection wells	Potentially feasible; potential clogging problems due to water quality
		Spreading basins	Potentially feasible
	Discharge to surface water	Transmission system	Potentially feasible
	Discharge to irrigation canal system	Transmission system	Potentially feasible; seasonal use of water
	Discharge to industrial user	Transmission system	Potentially feasible; limited by demand
	Discharge to sewer (POTW)	Transmission system	Potentially feasible; limited capacity of current POTW to receive discharge

Table 5-21
(Continued)

General Response Action	Technology	Process	Feasibility Screening Comments
Pumping and Onsite Treatment at a Central Treatment Facility (continued)			
	Discharge to potable water system	Transmission system	Potentially feasible; limited by demand and capacity of current water supply system to receive discharge

5. Groundwater extraction from Subunit C at a higher rate than Option 4, treatment that exceeds background by air stripping, granular activated carbon polishing, and discharge to Subunit C by reinjection or incorporation of treated water into the potable water supply

Three options were considered for the removal of MEK from Subunit A groundwater:

- o Ultraviolet/ozone
- o Steam stripping, vacuum steam stripping
- o Hot air stripping

The technology evaluation process examined a number of extraction, treatment, and end use alternatives. These are discussed in the Unidynamics Feasibility Study, Chapter 4, and the EPA September 7, 1989, memo listed in the Administrative Record Index (Appendix A).

Screening of Alternatives

The groundwater options were screened based on the requirements outlined in SARA and CERCLA and based on effectiveness, implementability, and cost. Comparative analyses were performed so that options that may be unprotective, ineffective, difficult to implement, or excessively costly would be screened from the list of potentially viable options and dropped from further consideration.

Based on this rationale, two alternatives were eliminated:

- o Ultraviolet/ozone treatment for MEK removal
- o Steam stripping, vacuum steam stripping for MEK removal

The summary of the technical evaluation for the remedial action alternatives for groundwater contaminated by VOCs is presented in Table 5-22.

EVALUATION OF ALTERNATIVES

The evaluation of alternatives was undertaken to provide the information needed to select an appropriate action that protects human health and the environment and is cost-effective. The evaluation was performed within the statutory and policy framework mandated by CERCLA and SARA. The evaluation of the various alternatives was based on the following factors:

- Technical considerations of the hydrogeologic setting
- Beneficial use of groundwater
- Uncertainties in the fate and transport of TCE in the groundwater flow system
- Results of the Endangerment Assessment regarding public health and the environment
- ARARs and other institutional programs
- Effectiveness in meeting remedial action objectives, implementability, and cost-effectiveness

A summary of the detailed analysis of groundwater alternatives is presented in Table 5-23. Detailed costs are presented in Table 5-24.

No Action Alternative. The no action alternative would allow the groundwater contamination to spread over an ever-widening area and would likely have continuing adverse environmental and health consequences. These include exposure to carcinogens and other harmful contaminants through ingestion of water and soil and inhalation of soil gas released from pumped groundwater.

Extraction/Treatment Alternatives. The pumping alternatives for both Subunit A and C accomplish the objective of stopping migration of contaminants at the UPI site. When coupled with treatment, they also reduce the volume, mobility, and toxicity of the groundwater contaminants. Pumping to extract contaminated groundwater would prevent migration of contaminants from the chosen pumping area. This technology has been demonstrated to be successful in other areas. Aquifer rehabilitation estimations are based on hydrogeologic principles and regional flow characteristics; consequently, the rate of extraction will impact the time required for rehabilitation. Analysis of water samples from monitoring wells for contaminant levels will indicate aquifer cleanup. Operation is relatively simple and is not expected to significantly affect the alternative's reliability. It is likely that during the remedial action, some components will require maintenance or replacement. No impediments to well construction are foreseen; however, safety hazards may be present during construction. These

Table 5-22
SUMMARY OF THE SCREENING OF
GROUNDWATER AQUIFER REMEDIAL ACTIONS

Alternative	Implementability	Effectiveness	Relative Cost
1. No Action	N/A	N/A	Low
2. Groundwater extraction from the area in Subunit A above 100 ppb TCE. Treatment by air-stripping with vapor phase carbon and reinjection to Subunit A.	A groundwater extraction, treatment, and reinjection system would be relatively easy to construct and implement.	The ability of the system to extract contaminants is fairly certain. The duration of the action is estimated at 20 years.	Medium
3. Groundwater extraction from Subunit A treatment that exceeds ARARs by air stripping with vapor phase carbon, granular activated carbon polishing, and reinjection to Subunit A.	A groundwater extraction, treatment, and reinjection system would be relatively easy to construct and implement.	The ability of the system to extract contaminants is fairly certain. The duration of the action is estimated at 25 years.	Medium to High
4. Groundwater extraction from Subunit A at a higher rate than Option 3, treatment that exceeds background by air stripping with vapor phase carbon, granular activated carbon polishing, and reinjection to Subunit A.	A groundwater extraction, treatment, and reinjection system would be relatively easy to construct and implement.	The ability of the system to extract contaminants is fairly certain. The duration of the action is estimated at 17 years.	High
5. Groundwater extraction from Subunit C, treatment that exceeds ARARs by air stripping, granular activated carbon polishing, and discharge to Subunit C by reinjection or incorporation of treated water into the potable water supply.	A groundwater extraction, treatment, and reinjection or distribution system would be relatively easy to construct and implement. Community opposition may prohibit introduction of treated groundwater into potable supply.	The ability of the system to extract contaminants is fairly certain. The duration of the action is estimated at 25 years.	Low
6. Groundwater extraction from Subunit C at a higher rate than Option 5, treatment that exceeds background by air stripping and granular activated carbon polishing, discharge to Subunit C by reinjection or incorporation of treated water into the potable water supply.	A groundwater extraction, treatment, and reinjection or distribution system would be relatively easy to construct and implement. Community opposition may prohibit introduction of treated groundwater into potable supply.	The ability of the system to extract contaminants is fairly certain. The duration of the action is estimated at 25 years.	Low

Table 5-22
(Continued)

Alternative	Impelementability	Effectiveness	Relative Cost
7. Ultraviolet/ozone treatment for MEK removal.	A groundwater treatment system for MEK removal would be relatively easy to construct and implement.	May not be effective because high carbonate levels interfere with ozone oxidation; ultraviolet light intensity reduces rapidly due to filming of quartz tubes. Influent MEK concentrations are difficult to predict.	High
8. Steam stripping, vacuum steam stripping for MEK removal.	A groundwater treatment system for MEK removal would be relatively easy to construct and implement.	May not be effective because high calcium carbonate calcium sulfate concentrations will scale portions of these units. Influent MEK concentrations are difficult to predict.	Medium to High

Table 5-23
DETAILED ANALYSIS OF GROUNDWATER ALTERNATIVES

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Details of Alternatives	o Groundwater quality monitoring	o Groundwater quality monitoring	o Groundwater quality monitoring	o Groundwater quality monitoring	o Groundwater quality monitoring	o Groundwater quality monitoring
	o Aquifer use restrictions	o Extract groundwater at 400 gpm for 20 years using four production wells	o Extract groundwater at 1,000 gpm for 25 years using nine production wells	o Extract groundwater at 3,000 gpm for 17 years using 24 production wells	o Extract groundwater at 40 gpm for 25 years using one extraction well	o Extract groundwater at 60 gpm for 25 years using one extraction well
	o No remedial action taken	o Pipe to UniDynamics facility	o Pipe to UniDynamics facility	o Pipe to UniDynamics facility		
		o Treatment will include volatile organic air stripping with vapor phase carbon and granular activated carbon polishing	o Treatment will include volatile organic air stripping with vapor phase carbon and granular activated carbon polishing	o Treatment will include volatile organic air stripping with vapor phase carbon and granular activated carbon polishing	o Treatment will include volatile organic air stripping and granular activated carbon polishing	o Treatment will include volatile organic air strip ping and granular activated carbon polishing
		o Reinject treated water into Unit A aquifer	o Reinject treated water into Unit A aquifer	o Reinject treated water into Unit A aquifer	o Discharge into Subunit C aquifer by reinjection	o Discharge into Subunit C aquifer by reinjection
		o Treatment of stripped volatiles by vapor phase carbon	o Treatment of stripped volatiles by vapor phase carbon	o Treatment of stripped volatiles by vapor phase carbon	o Other beneficial uses may be appropriate and would be evaluated	o Other beneficial uses may be appropriate and would be evaluated
Community Acceptance		o Community is protected during con-construction and implementation	o Community is protected during construction and implementation	o Community is protected during construction and implementation	o Community is protected during construction and implementation	o Community is protected during construction and implementation
		o Workers are protected during construction and implementation	o Workers are protected during construction and implementation	o Workers are protected during construction and implementation	o Workers are protected during construction and implementation	o Workers are protected during construction and implementation
					o Community acceptance for drinking water end use will be low	o Community acceptance for drinking water end use will be low

Table 5-23
(Continued)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Short Term Effectiveness Protectiveness	o Community is protected by monitoring and aquifer use restrictions	o Short-term environmental impacts minimal	o Short-term environmental impacts minimal	o Short-term environmental impacts minimal	o Short-term environmental impacts minimal	o Short-term environmental impacts minimal
	o No adverse impacts on the environment from activities	o Construction complete within 1 year	o Construction complete within 1 year	o Construction complete within 1 year 6 months	o Construction complete within 6 months	o Construction complete within 6 months
	o Objectives may not be achieved	o Groundwater objective achieved in 20 years with removal of 5 pore volumes	o Goundwater objective achieved in 25 years with removal of 5 pore volumes	o Groundwater objective achieved in 17 years with removal of 5 pore volumes	o Groundwater objective achieved in 25 years with removal of 5 pore volumes	o Groundwater objective achieved in 25 years with removal of 5 pore volumes.
Long-Term Effectiveness and Permanence	o Existing and future risks remain	o Some risk remains at conclusion of remedial activities	o Low risk remains at conclusion of remedial activities	o Low risk remains at conclusion of remedial activities	o Low risk remains at conclusion of remedial activities	o Low risk remains at conclusion of remedial activities
					o Risk incurred of degrading water quality	o Risk incurred of degrading water quality
		o Conventional and specialized technologies with proven performance	o Conventional and specialized technologies with proven performance	o Conventional and specialized technologies with proven performance	o Conventional technologies with proven performance	o Conventional technologies with proven performance
		o Requires periodic maintenance and inspection during operations	o Requires periodic maintenance and inspection during operations	o Requires periodic maintenance and inspection during operations	o Requires periodic maintenance and inspection during operations	o Requires periodic maintenance and inspection during operations
					o Drinking water end use requires frequent monitoring of VOCs in treated water	o Drinking water end use requires frequent monitoring of VOCs in treated water

Table 5-23
(Continued)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Reduction of Toxicity, Mobility, or Volume (Considers alternative-specific target areas)	o No remediation measures taken	o Groundwater extraction to reduce mobility or migration of contaminated groundwater	o Groundwater extraction to reduce mobility or migration of contaminated groundwater	o Groundwater extraction to reduce mobility or migration of contaminated groundwater	o Groundwater extraction to reduce mobility or migration of contaminated groundwater	o Groundwater extraction to reduce mobility or migration of contaminated groundwater
		o Reduces volume of contaminated groundwater by treatment	o Reduces volume of contaminated ground water by treatment	o Reduces volume of contaminated ground water by treatment	o Reduces volume of contaminated groundwater by treatment	o Reduces volume of contaminated groundwater by treatment
		o Reduces mobility of organics in groundwater by collection	o Reduces mobility of organics in groundwater by collection	o Reduces volume of volatiles in air by treatment from Subunit A.	o Reduces volume of volatiles in air by treatment	o Reduces volume of volatiles in air by treatment
		o Reduces volume of volatiles in air by treatment	o Reduces volume of volatiles in air by treatment	o Reduces toxicity of collected organics by offsite incineration at a TSD facility		
		o Reduces toxicity of collected organics by offsite incineration at a TSD facility	o Reduces toxicity of collected organics by offsite incineration at a TSD facility			
		o A calculated 117,200 pounds of TCE and other VOCs is removed in 20 years	o A calculated 117,900 pounds of TCE and other volatile organics currently estimated to be present is removed from the groundwater in 25 years	o A calculated 118,200 pounds of TCE and other volatile organics currently estimated to be present is removed from the groundwater in 17 years	o A calculated 44 pounds of TCE and other volatile organics currently estimated to be present is removed from the groundwater in 25 years	o A calculated 7 pounds of TCE and other volatile organics currently estimated to be present is removed from the groundwater in 25 years
		o High TDS eliminates steam stripping, UV/ozone, etc.; thus removal of MEK to health advisory levels may not be realized	o High TDS eliminates steam stripping, UV/ozone, etc.; thus removal of MEK to health advisory levels may not be realized	o High TDS eliminates steam stripping, UV/ozone, etc.; thus removal of MEK to health advisory levels may not be realized		

Table 5-23
(Continued)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Implementability		o Conventional technologies for extraction, treatment of organics	o Conventional tech nologies for extraction, treatment of organics	o Conventional tech nologies for extraction, treatment of organics	o Conventional technologies for extraction, treatment of organics, and reinjection of treated water or drinking water end use	o Conventional technologies for extraction, treatment of organics, and reinjection of treated water or drinking water end use
		o High TDS may make reinjection of treated water difficult to implement. Reinjection of Subunit A water has been successfully implemented in the south portion of the site	o High TDS may make reinjection of treated water difficult to implement. Reinjection of Subunit A water has been successfully implemented in the south portion of the site	o High TDS may make reinjection of treated water diffi cult to implement Reinjection of Subunit A water has been successfully implemented in the south portion of the site		
		o Adequate work force and equipment available	o Adequate work force and equipment available	o Adequate work force and equipment available	o Adequate work force and equipment available	o Adequate work force and equipment available
		o Good performance in collection and treatment of volatile organics	o Good performance in collection and treatment of volatile organics	o Good performance in collection and treatment of volatile organics	o Good performance in collection and treatment of volatile organics	o Good performance in collection and treatment of volatile organics
		o Low reliability and high maintenance of reinjection system	o Low reliability and high maintenance of reinjection system	o Low reliability and high maintenance of reinjection system	o Good reliability, but high maintenance of reinjection system	o Good reliability, but high maintenance of reinjection system
		o Requires periodic monitoring	o Requires periodic monitoring	o Requires periodic monitoring	o Reinjection end use requires periodic monitoring	o Reinjection end use requires periodic monitoring
					o Drinking water end use requires frequent monitoring of VOCs in treated water	o Drinking water end use requires frequent monitoring of VOCs in treated water
					o Drinking water end use requires highly reliable process control instrumentation	o Drinking water end use requires highly reliable process control instrumentation

Table 5-23
(Continued)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
State Acceptance	o Agency approval unlikely	o Requires PQGWWP* or Type 2 water right	o Requires PQGWWP or Type 2 water right	o Requires PQGWWP or Type 2 water right	o Requires PQGWWP or Type 2 water right	o Requires PQGWWP or Type 2 water right
	o Aquifer use monitored through ADWR permitting program	o High TDS eliminates steam stripping, UV/ozone, etc.; thus removal of MEK to health advisory levels may not be realized	o High TDS eliminates steam stripping, UV/ozone, etc.; thus removal of MEK to health advisory levels may not be realized	o High TDS eliminates steam stripping, UV/ozone, etc.; thus removal of MEK to health advisory levels may not be realized	o Potential adverse impact on other groundwater users	o Potential adverse impact on other groundwater users
		o Substantial permit requirements for groundwater reinjection must be met	o Substantial permit requirements for groundwater reinjection must be met	o Substantial permit requirements for groundwater reinjection must be met	o Substantial permit requirements for groundwater reinjection must be met	o Substantial permit requirements for groundwater reinjection must be met
		o Approval from agencies likely	o Approval from agencies likely	o Approval from agencies likely	o Approval from agencies likely	o Approval from agencies likely
Costs						
Capital Costs	$ 0	$2,583,000	$ 4,041,000	$ 9,138,000	$ 503,700	$ 514,000
Annual Costs	$ 30,000	$ 263,000	$ 576,000	$ 1,621,000	$ 97,000	$ 105,400
Present Worth Costs	$461,000	$5,861,000	$12,157,000	$27,407,000	$1,870,000	$2,000,000
					o Drinking water end use alternate may decrease capital cost, but sensitive to process instrumentation requirements	o Drinking water end use alternate may decrease capital cost, but sensitive to process instrumentation requirements
Compliance with ARARs	o ARARs may not be achieved	o ARARs may not be achieved	o EPA target levels and ARARs based on MCLs for groundwater achieved at conclusion of remedial action	o EPA target levels and ARARs based on MCLs for groundwater achieved at conclusion of remedial action	o ARARs based on MCLs for groundwater achieved at conclusion of remedial action	o ARARs based on MCLs for groundwater achieved at conclusion of remedial action
			o Meets ARARs for end use of recharge	o Meets ARARs for reinjection to Subunit A aquifer	o Meets ARARs for reinjection to Subunit C aquifer	o Meets ARARs for reinjection to Subunit C aquifer
					o Meets ARARs for drinking water end use	o Meets ARARs for drinking water end use

*PQGWWP-Poor Quality Groundwater Withdrawal Permit.

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Table 5-23
(Continued)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Overall Protection of Human Health and the Environment	o Risks remain	o Risks remain	o Short-term risks are low with short imple mentation times for treatment and pro tection of community and workers	o Short-term risks are low with short imple mentation times for treatment and pro tection of community and workers	o Short-term risks are low with short imple mentation times for treatment and pro tection of community and workers	o Short-term risks are low with short imple mentation times for treatment and pro tection of community and workers
		o Risks to human health are reduced; contam ination will still exist in Subunit A at conclusion of remedial action	o Risks are reduced up to the point where extraction to capture TCE in excess of 100 ppb isocon occurs; pump ing to capture TCE to lower concentra tions may not result in further risk reduction	o Risks are reduced up to the point where extraction to capture TCE in excess of 100 ppb isocon occurs; pump ing to capture TCE to lower concentra tions may not result in further risk reduction	o Risks are reduced with objectives met in 25 years	o Risks are reduced with objectives met in 25 years
			o Long-term permanent effectiveness	o Long-term permanent effectiveness	o Increase risks from migration of contaminants	o Increase risks from migration of contaminants
			o In order to remove MEK to draft health advisory levels, additional extract tion and granular activated carbon treatment would be required; the extent of additional extraction has not been precisely calculated.	o In order to remove MEK to draft health advisory levels, additional extrac tion and granular activated carbon treatment would be required; the extent of additional extraction has not been precisely cal culated.	o In order to remove MEK to draft health advisory levels, additional extrac tion and granular activated carbon treatment would be required; the extent of additional extrac tion has not been precisely calculated.	
			Draft health advi sory levels are not ARARs and may only be considered as water quality goals.	Draft health advi sory levels are not ARARs and may only be considered as water quality goals.	Draft health advi sory levels are not ARARs and may only be considered as water quality goals.	

Table 5-24
DETAILED COST ANALYSIS FOR GROUNDWATER ALTERNATIVES

ALTERNATIVE 2

1,000-GPM EXTRACTION/AIR STRIPPING/
VAPOR PHASE PHASE CARBON/
GRANULAR ACTIVATED CARBON POLISHING/
REINJECTION

DIRECT COSTS

Groundwater Extraction System Nine wells, six of 115-gpm capacity and three of 100-gpm capacity, 7.5 hp, 231 feet of head at $22,000 each; six stainless steel pumps at 115 gpm, three pumps at 100 gpm at $6,000 each; FRP piping, 3-inch to 6-inch-diameter, total length of 10,700 feet at $329,200	$	567,000
Air Stripping System Two FRP air stripping towers, 8.0 feet diameter by 20 feet total height with 15 feet polyethylene packing; 25.00 cfm blower (30 hp), operating at G/L of 160, with liquid pumps (25 hp), flowmeters, valves piping, and fittings		390,000
Source: Vendor Information		
Vapor Phase Carbon System Skid-mounted vapor phase carbon system sized for 50,000 cfm gas flow, steam boiler, off-gas chiller, knockout drum, and preheater		380,000
Source: Vendor Discussions		
Granular Activated Carbon Polishing System Skid-mounted - two granular activated carbon beds, each 12 feet in diameter, 12 feet in height, containing 38,000 pounds granular activated carbon. Beds piped in series, upflow and backwashable. Includes backwash pumps, pipes, and fittings.		244,000
Source: Vendor Discussions		
Foundation Pad Dimensions: 50 feet by 100 feet x 6 inches with 6-inch curb. Concrete at $125/cubic yard. Float finish.		15,500
Tanks Two 30,000-gallon epoxy-coated steel feed and treated water tanks One 10,000-gallon epoxy-coated tank		88,000

Table 5-24
(Continued)

ALTERNATIVE 2 (continued)

DIRECT COSTS (continued)	
Utilities Hookups 480V/3-phase 600-amp electrical service is provided to the process pad: $30,000 Gas: $9,000 Water: $6,000	45,000
Discharge System Eighteen 60-gpm-capacity reinjection wells at $20,000/well with 14,000 feet of 8-inch-diameter pipe; includes trenching and backfilling	1,065,000
Interunit Piping 8 percent of capital equipment cost	140,000
Instrumentation 12 percent of capital equipment cost (not to include discharge system)	140,000
Installation and Testing Mobilization/demobilization: $25,000 Tank rigging and replacement: $33,000 Process piping: $75,000 Electrical: $25,000 Pressure and water testing: $3,500	161,500
Subtotal Direct Costs	$3,236,000
INDIRECT COSTS	
Engineering 12 percent of total direct costs	$ 345,000
Startup One Engineer at 50 hours/week at $70/hour	14,000
Permits Per onsite estimate	15,000
Contingency 15 percent of total direct costs	431,000
Subtotal Indirect Costs	$ 805,000
Total Capital Costs, Alternative 2	$4,041,000

Table 5-24
(Continued)

ALTERNATIVE 2 (continued)

ANNUAL COSTS	
Monitoring	$ 30,000
Groundwater Extraction System Electrical at $0.10/kWh: $43,000 Maintenance (pump and well) at $700/well: $6,300 Maintenance (piping repair) at 1 percent of withdrawal system capital cost: $6,700	56,000
Air Stripping System Electrical: $105,000 Biocide: $87,500 Maintenance at 3 percent of air stripping system capital cost: $11,700	204,000
Vapor Phase Carbon System Electrical: $62,500 Maintenance at 3 percent of vapor phase system capital cost $11,400	73,900
Granular Activated Carbon Polishing System Includes electrical, regeneration of 51,000 pounds carbon/year at $1.20/pound	70,000
Plant Operator 1/2 time to conduct maintenance, repair, and sampling activities	15,000
Sampling Two samples per week	10,000
Waste Disposal Recycling/incineration of concentrated liquid organic at approved facility	5,400
Tank Maintenance Painting/cleaning/repair	1,500
Process Automation 2 percent of instrumentation capital costs plus periodic cleaning of probes	3,000
Discharge System Well pump maintenance and pipe repair at 10 percent of discharge system capital costs	107,000
Total Annual Costs, Alternative 2	$ 576,000

Table 5-24
(Continued)

ALTERNATIVE 3

3,000-GPM EXTRACTION/AIR STRIPPING/
VAPOR PHASE CARBON/
GRANULAR ACTIVATED CARBON POLISHING/
REINJECTION

DIRECT COSTS	
Groundwater Extraction System 24 wells at $20,000 per well; 24 stainless steel pumps, 125 gpm, 15 hp, 300 feet of head at $5,000 each; FRP piping, 3-inch to 14-inch diameter, total length of 20,000 feet: $775,000	$1,375,000
Air Stripping System Two 14-foot-diameter by 20-foot-high FRP air stripping tower with 15 feet polyethylene packing. 3,000-gpm liquid flow rate, approximately 60,000-cfm gas flowrate/tower, TCE influent at 34,000 ppb, blower, flowmeter, valves, piping, and fittings	755,000
Vapor Phase Carbon System Skid-mounted, 120,000-cfm gas flow rate, steam boiler, off-gas chiller, knockout drum, and preheater	675,000
Granular Activated Carbon Polishing System Two parallel skid-mounted trains of two granular activated carbon upflow beds, connected in series, backwashable; containing 38,000 pounds granular activated carbon per bed; includes backwash pumps, pipes, and fittings	488,000
Foundation Pad 100 feet by 100 feet by 6-inch reinforced concrete, #4 rebar each face, each way, concrete at $125/cubic yard, float finish	28,000
Tanks Two 45,000-gallon epoxy-coated steel feed and treated water tanks; one 30,000-gallon epoxy-coated backwash tank	128,000
Utilities Hookups Includes gas, water, and electrical	60,000
Interunit Piping 8 percent of capital equipment costs	164,000
Instrumentation 12 percent of capital equipment costs	260,000

Table 5-24
(Continued)

ALTERNATIVE 3 (continued)

DIRECT COSTS (continued)	
Discharge System 48 - 65-gpm-capacity injection wells at $20,000 per well with 14,000 feet of 14-inch-diameter pipe. Includes trenching and backfilling.	3,059,000
Installation and Testing Includes installation of tanks and interunit piping, testing of well pumps and pipelines, mobilization, and demobilization	180,000
Subtotal Direct Costs	$7,172,000
INDIRECT COSTS	
Engineering 12 percent of total direct costs	$ 861,000
Startup One Engineer at 50 hours/week at $70/hour for 4 weeks	14,000
Permits Per onsite estimate (FS)	15,000
Contingency 15 percent of total direct costs	1,076,000
Subtotal Indirect Costs	$1,966,000
Total Capital Costs, Alternative 3	$9,138,000
ANNUAL COSTS	
Monitoring	$ 30,000
Groundwater Extraction System Electrical at $0.10/kWh: $117,000 Maintenance (pump and well) at $700/well: $17,000 Maintenance (piping repair) at 1 percent of withdrawal system capital cost: $14,000	148,000

Table 5-24
(Continued)

ALTERNATIVE 3 (continued)

ANNUAL COSTS (continued)	
Air Stripping System Electrical: $265,000 Biocide: $263,000 Maintenance at 3 percent of air stripping system capital cost: $23,000	$ 551,000
Vapor Phase Carbon System Electrical: $100,000 Maintenance at 3 percent of vapor phase carbon system capital costs: $20,000	120,000
Granular Activated Carbon Polishing System Electrical: $75,000 Carbon regeneration at 228,000 pounds/year at $1.20/pound: $274,000 Maintenance at 3 percent of granular activated carbon polishing system: $15,000	364,000
Discharge System Pipeline maintenance at 10 percent of discharge system capital costs	306,000
Plant Operator - Full-time	30,000
Sampling Two samples per week	10,000
Waste Disposal Recycling/incineration of concentrated liquid organic at approved facility	50,000
Tank Maintenance Painting/cleaning/repairing	5,000
Process Automation 2 percent of instrumentation system capital costs plus periodic cleaning of probes	7,000
Total Annual Costs, Alternative 3	$1,621,000

Table 5-24
(Continued)

ALTERNATIVE 4

40-GPM EXTRACTION/AIR STRIPPING/
GRANULAR ACTIVATED CARBON POLISHING/
REINJECTION

DIRECT COSTS

Groundwater Extraction System One well of 40 gpm capacity at $20,000; one stainless steel pump, 40 gpm, 7-1/2 hp, 400 feet of head at $5,000; FRP piping, 2-inch for 400 feet: $3,800	$	28,800
Air Stripping System One 1-1/2-foot-diameter by 17-foot-high FRP air stripping tower with 12 feet polyethylene packing, 40-gpm liquid flow rate, 535-cfm gas flow rate, 1-hp blower, TCE influent at 21 ppb, flowmeter, valves, piping, and fittings		10,000
Granular Activated Carbon Polishing System Two 2,000-pound granular activated carbon beds connected in series, approximately 4 feet diameter by 11 feet high each, 40-gpm flow rate, TCE influent at <5.0 ppb, 99 percent removal		17,800
Foundation Pad 50-foot by 100-foot by 6-inch reinforced concrete with 6-inch curb, #4 rebar each face, each way, concrete at $125/cubic yard, float finish		15,500
Tanks Two 5,000-gallon epoxy-coated steel feed and treated water tanks Two 1,125-gallon epoxy-coated backwash tanks		19,000
Utilities Hookups 480V/3-phase 400-amp electrical service transformer to process pad: $25,000 Gas: $9,000 Water: $6,000		40,000
Discharge System Two 20-gpm-capacity injection wells at $20,000 each with 6,000 feet of 2-inch-diameter pipe; includes trenching and backfilling		150,000
Interunit Piping FRP piping 2-inch for 5,600 feet; includes trenching and backfilling, 8 percent of capital equipment costs		19,300

Table 5-24
(Continued)

ALTERNATIVE 4 (continued)

DIRECT COSTS (continued)	
Instrumentation 12 percent of capital equipment costs	29,000
Installation and Testing 15 percent of capital equipment costs	36,300
Subtotal Direct Costs	$ 365,700
INDIRECT COSTS	
Engineering 12 percent of total direct costs	44,000
Startup 10 percent of capital equipment costs	24,000
Permits Per onsite estimate (FS)	15,000
Contingency 15 percent of total direct costs	55,000
Subtotal Indirect Costs	$ 138,000
Total Capital Costs, Alternative 4	$ 503,700
ANNUAL COSTS	
Monitoring	$ 30,000
Groundwater Extraction System Electrical at $0.10/kWh: $5,000 Maintenance (pump and well) at $700/well: $700 Maintenance (piping repair) at 1 percent of withdrawal system capital cost: $2,900	8,600
Air Stripping System Electrical: $8,000 Biocide: $3,500 Maintenance at 3 percent of air stripping system capital cost: $500	12,000
GAC Polishing System Includes electrical for 1-hp feed and backwash pump and periodic changeout and decommissioning (one bed per year)	4,000

Table 5-24
(Continued)

ALTERNATIVE 4 (continued)

ANNUAL COSTS (continued)	
Plant Operator 1/2 time of annual salary of $30,000	$ 15,000
Sampling Two samples per week	10,000
Tank Maintenance Painting/cleaning/repair	1,500
Process Automation 2 percent of instrumentation capital cost plus periodic cleaning of probes	1,000
Discharge System 10 percent of discharge piping capital cost	15,000
Total Annual Costs, Alternative 4	$ 97,000

Table 5-24
(Continued)

ALTERNATIVE 5

60-GPM EXTRACTION/AIR STRIPPING/
GRANULAR ACTIVATED CARBON POLISHING/
REINJECTION

DIRECT COSTS

Groundwater Extraction System One well of 60 gpm capacity at $20,000; one stainless steel pump, 60 gpm, 7-1/2 hp, 400 feet of head at $5,000; FRP piping, 2-inch for 400 feet: $3,800	$ 28,800
Air Stripping System One 2-foot-diameter by 17-foot-high FRP air stripping tower with 12 feet polyethylene packing, 60-gpm liquid flow rate, 960-cfm gas flow rate, 1-hp blower, TCE influent at 5 ppb, flowmeter, valves, piping, and fittings	10,000
Granular Activated Carbon Polishing System Two 2,000-pound granular activated carbon beds connected in series, approximately 4 feet in diameter by 11 feet high each, 60-gpm flow rate, TCE influent at <5.0 ppb, 99 percent removal	17,800
Foundation Pad 50-foot by 100-foot by 6-inch reinforced concrete with 6-inch curb, #4 rebar each face, each way, concrete at $125/cubic yard, float finish	15,500
Tanks Two 7,500-gallon epoxy-coated steel feed and treated water tanks two 2,000-gallon epoxy-coated backwash tanks	24,800
Utilities Hookups 480V/3-phase 400-amp electrical service transformer to process pad: $25,000 Gas: $9,000 Water: $6,000	40,000
Discharge System Two 30-gpm-capacity injection wells at $20,000 each with 6,000 feet of 2-inch-diameter pipe; includes trenching and backfilling	150,000
Interunit Piping 8 percent of capital equipment costs	19,800

Table 5-24
(Continued)

ALTERNATIVE 5 (continued)

DIRECT COSTS (continued)	
Instrumentation 12 percent of capital equipment costs	29,700
Installation and Testing 15 percent of capital equipment costs	37,000
Subtotal Direct Costs	$ 373,400
INDIRECT COSTS	
Engineering 12 percent of total direct costs	$ 44,800
Startup 10 percent of capital equipment costs	24,800
Permits Per onsite estimate (FS)	15,000
Contingency 15 percent of total direct costs	56,000
Subtotal Indirect Costs	$ 140,600
Total Capital Costs, Alternative 5	$ 514,000
ANNUAL COSTS	
Monitoring	$ 30,000
Groundwater Extraction System Electrical at $0.10/kWh: $7,500 Maintenance (pump and well) at $700/well: $700 Maintenance (piping repair) at 1 percent of withdrawal system capital cost: $2,900	11,100
Air Stripping System Electrical: $12,000 Biocide: $5,300 Maintenance at 3 percent of air stripping system capital cost: $500	17,800
Granular Activated Carbon Polishing System Includes electrical for 1-hp feed and backwash pumps and periodic changeout and decommissioning (one bed per year)	4,000

Table 5-24
(Continued)

ALTERNATIVE 5 (continued)

ANNUAL COSTS (continued)	
Plant Operator 1/2 time of annual salary of $30,000	$ 15,000
Sampling Two samples per week	10,000
Tank Maintenance Painting/cleaning/repair	1,500
Process Automation 2 percent of instrumentation capital cost plus periodic cleaning of probes	1,000
Discharge System 10 percent of discharge piping capital cost	15,000
Total Annual Costs, Alternative 5	$ 105,400

will be considered in construction plans. If pump failure were to occur, there would be no short-term release of contaminants pending repair that could pose a threat to public health or the environment.

Air stripping with vapor phase carbon (Subunit A groundwater aquifer alternatives only) and granular activated carbon polishing achieve the desired goal of reducing volume and toxicity of the groundwater contaminants sufficiently to meet the applicable and appropriate requirements and will likely exceed those requirements. Treatment of contaminated groundwater by air stripping has been shown to be very effective with removals of organic contaminants often exceeding 99.9 percent. Granular activated carbon polishing for removal of MEK and acetone may be equally as effective. These procedures are relatively predictable, and they have been used successfully at a number of CERCLA sites. Equipment is relatively easy to operate once initial adjustments have been completed. Operator training will be required. Occasional attention for adjustment, monitoring, and testing will be required. With industrial-grade components and regular preventive maintenance, process integrity should be 10 years or more. Scaling of air stripping tower internals has been a problem at some sites. A small amount of anti-scalant, such as hypochlorite, would be required to remedy this. Also, spent carbon from the granular activated carbon beds will require periodic regeneration.

If, in the implementation of the remedial action, EPA determines that air stripping cannot treat MEK to the level required by the ARARs, then hot air stripping and scale control methods will be employed unless EPA determines that the technology is impracticable. If the technology to treat MEK is impracticable, EPA will waive compliance with the MEK ARAR pursuant to CERCLA Section 121(d)(4), and set an alternative limit that is protective of human health and the environment.

Numerous vendors are available to produce the process components. Conventional materials for construction are required.

All equipment items can be shop-fabricated and skid-mounted, making field erection easier. Construction for implementation of Alternatives 2 and 3 could take up to one year, and 6 months for Alternatives 4 and 5. Catastrophic failure of components is unlikely, and any threat to public health and the environment is relatively low.

For the Subunit A groundwater treatment alternatives, air emission controls will be placed on the air stripping towers. SARA states that a remedy should reduce the toxicity, mobility, and volume of contaminants. The Maricopa County Air Pollution Control Board requires that all new plants with air emissions "will adequately dilute, reduce, or eliminate the discharge of air pollution to adjoining property." This requirement is also known as reasonably achievable control technology (RACT), and in this case, RACT is air emission controls such as activated carbon adsorption

6. REFERENCES

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UniDynamics Phoenix, Inc. 1989. Remedial Investigation/ Feasibility Study. Phoenix-Goodyear Airport.

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U.S. EPA. 1985b. Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites. Final Report. Office of Waste Programs Enforcement, Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. EPA. 1987a. Final Feasibility Study for Section 16 Operable Unit. Goodyear, Arizona. October 19, 1987.

U.S. EPA. 1987b. Record of Decision Summary for Section 16 Operable Unit. Phoenix-Goodyear Airport Superfund site. September 25, 1987.

U.S. EPA. 1988. Federal Register. Drinking Water Regulations; Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper; Proposed Rule 40 CFR Parts 141 and 142. August 18, 1988.

U.S. EPA. 1989a. Remedial Investigation/Feasibility Study. Phoenix-Goodyear Airport.

U.S. EPA. 1989b. Integrated Risk Information System (IRIS) Database.

U.S. EPA. 1989. Federal Register. National Primary and Secondary Drinking Water Regulations; Proposed Rule 40 CFR, Parts 141, 142, and 143.

Appendix A
INDEX OF ADMINISTRATIVE RECORD

Appendix A
INDEX OF ADMINISTRATIVE RECORD

Date of Publication	
Sept. 1983	Ecology and Environment, Inc. Site Inspection Report, Goodyear Aerospace Corporation. September 1983. Presents sampling results of community wells in the vicinity of the Phoenix-Goodyear Airport. Identifies potential waste generators in the area.
June 1984	Ecology and Environment, Inc. Final Workplan RI/FS Litchfield Airport Area. Goodyear, Arizona. June 1984. Describes the activities to be carried out and the methodology for the remedial investigation and feasibility study of the Litchfield Airport Area (later renamed the Phoenix-Goodyear Airport).
June 1984	Unidyanamics Phoenix, Inc. Dry Well Soil Testing Project, Unidynamics Phoenix, Inc. Goodyear, Arizona. Prepared by Western Technologies, Inc. June 1984. Describes volatile organic compound sampling and results of soil samples collected near dry wells at the Unidynamics facility.
Aug. 1984	Engineering-Science, Inc. Contamination Assessment Plan. August 1984. Provides revised plan for assessment of groundwater contamination in the vicinity of the Goodyear Aerospace Corporation facility (currently owned by Loral Corporation). This was done as a requirement of Administrative Order 84-02 issued by EPA, Region IX.

Date of Publication	
Oct. 1984	U.S. EPA. Final Community Relations Plan. Phoenix-Litchfield Airport Area. Prepared by CH2M HILL. October 1984. Prepared as part of Phase I of the RI/FS to provide a means of gathering background, site history, and a discussion of the concerns of interested parties.
Nov. 1984	U.S. EPA. Quality Assurance Project Plan. Indian Bend Wash and Phoenix-Litchfield Airport Area Sites. Prepared by Ecology and Environment, Inc. November 1984. Describes procedures for ensuring quality control and reliability of sampling procedures, field measurements, equipment maintenance, analytical procedures, data management, and document control.
1985	City of Goodyear. Comprehensive Plan. City of Goodyear, Arizona. 1985. Presents expected future population growth, distribution, and land use.
Jan. 1985	Unidynamics Phoenix, Inc. Results of the First Phase of the Hydrogeologic Studies at the Unidynamics Phoenix, Inc., Goodyear Facility. Prepared by Dr. Kenneth D. Schmidt. January 1985. Provides results and hydrogeologic interpretations from the drilling and sampling of four monitoring wells at the Unidynamics site.
May 1985	Goodyear Aerospace Corporation. Evaluation of Soils and Shallow Groundwater Contamination. Prepared by Engineering-Science, Inc. May 1985.

Date of Publication

Presents test locations, methods, and results of the soil sampling and piezometer installation program conducted at the Goodyear Aerospace facility.

July 1985 — Unidynamics Phoenix, Inc. Results of Continued Remedial Investigation of the Unidynamics-Phoenix, Inc. site. Prepared by Dames and Moore. July 1985.

Presents results for the drilling and sampling of onsite monitoring wells, aquifer testing, and water level measurements.

Aug. 1985 — Goodyear Aerospace Corporation. Remedial Investigation, Phase I Results, Contamination Assessment Report, Goodyear Aerospace Corporation, Litchfield Park, Arizona. Prepared by Engineering-Science, Inc. August 1985.

Presents results of Phase I drilling and depth-specific monitoring well installation. Includes water quality and aquifer testing results.

Jan. 1986 — U.S. EPA. Task 5.3 Phase I Data Summary/ Report. Phoenix-Litchfield Airport Area Remedial Investigation. 2 Volumes. Prepared by Ecology and Environment, Inc. January 17, 1986.

Presents data regarding aquifers, soil materials, and contamination beneath the PGA area.

Jan. 1986 — U.S. EPA. Task 4.0 Source Verification, Field Investigation. Phoenix-Litchfield Airport Area Remedial Investigation. 2 Volumes. Prepared by Ecology and Environment, Inc. January 31, 1986.

Date of
Publication

Provides a history of hazardous waste disposal practices, assessment of known and suspected contaminant source areas, and a determination of other potential sources.

Feb. 1986 — Unidynamics Phoenix, Inc. Soil Gas Investigation Report, Unidynamics Phoenix, Inc., Goodyear, Arizona. Prepared by Tracer Research Corporation. February 1986.

Discusses soil gas sampling and mobile analysis conducted at the Unidynamics facility.

Apr. 1986 — U.S. EPA. PLA Sampling Plan. Prepared by Ecology and Environment, Inc. March 19, 1986.

Provides objectives, methods, and procedures for semiannual well water sampling and analysis. Sampling was done in April 1986.

Oct. 1986 — U.S. EPA. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, Office of Solid Waste and Emergency Response, Washington, D.C. October 1986.

Establishes framework for public health evaluations at Superfund sites.

Oct. 1986 — U.S. EPA. Technical Memorandum: Results of Soil Gas Sampling and Analysis. Phoenix-Litchfield Airport Remedial Investigation Phase II, Stage 1. Prepared by CH2M HILL. October 3, 1986.

Discusses soil gas sampling and mobile analysis conducted at the PGA superfund site from July 17 to 25, 1985.

Date of Publication

Dec. 1986 — Goodyear Aerospace Corporation. Evaluation of Logging and Depth-Specific Sampling of Goodyear Aerospace Corporation Production Wells. Prepared by Engineering-Science, Inc. December 1986.

Presents results and interpretations of geophysical logging and sampling of production wells at the former GAC facility.

Feb. 1987 — U.S. EPA. Soil Gas Technical Memorandum RI/FS. Phoenix-Goodyear Airport. Prepared by CH2M HILL. February 27, 1987.

Discusses soil gas and mobile analysis conducted at the PGA Superfund site from January 3 to 22, 1987.

June 1987 — U.S. EPA. Soil Sampling Plan. Phoenix-Goodyear Airport RI/FS. Prepared by CH2M HILL. June 29, 1987.

Presents locations, rationale, and methodology for soil samples collected from the southern portion of the study area.

July 1987 — Unidynamics Phoenix, Inc. Soil Sampling Plan for Unidynamics Facility. Prepared by Dames and Moore. July 1987.

Presents the locations, rationale and methodology for sampling and analysis of the Phase I soil sampling.

July 1987 — U.S. EPA. Interim Guidelines on Compliance with Applicable or Relevant and Appropriate Requirements. July 9, 1987.

Provides new guidance on selection of ARARs and MCLs as cleanup standards for Superfund sites. Incorporates SARA.

Date of Publication	
Sept. 1987	U.S. EPA. Record of Decision Summary for Section 16 Operable Unit. Phoenix-Goodyear Airport Superfund Site. Prepared by CH2M HILL. September 25, 1987. Presents EPA's preferred remedy for the Section 16 Operable Unit.
Oct. 1987	Loral Corporation. Environmental Audit Sampling Results, Loral Systems Division, Litchfield Park, Arizona. Prepared by Moretrench Environmental Services. October 1987. Presents analytical methods, QA/QC procedures and results for 15 soil samples collected at the former Goodyear Aerospace facility.
Oct. 1987	U.S. EPA. Technical Memorandum Results of the PGA Soils Investigation. Prepared by CH2M HILL. October 5, 1987. Presents the results of soil samples collected from the south portion of the study area during June and July, 1987.
Oct. 1987	U.S. EPA. Final Feasibility Study for Section 16 Operable Unit. Goodyear, Arizona. Prepared by CH2M HILL. October 19, 1987. Discusses and screens remedial actions for providing an expedited cleanup of the Section 16 Operable Unit.
Jan. 1988	U.S. EPA. Final Air Sampling Plan. Phoenix-Goodyear Airport RI/FS. Prepared by CH2M HILL. January 1988. Presents locations, rationale, methodology, and analytical protocol for ambient air samples collected from the southern portion of the study area.

Date of Publication	
Jan. 1988	U.S. EPA. Field Sampling Plan for Geophysical Logging and Depth Specific Sampling. Phoenix-Goodyear Airport Site. Prepared by CH2M HILL. January 20, 1988. Details procedures for logging and sampling of three production wells within the PGA site boundaries.
March 1988	Goodyear Tire and Rubber Company. Phase II Remedial Investigation Report Phoenix-Goodyear Airport Site. Prepared by Engineering-Science, Inc. March 1988. Discusses the installation and sampling of 19 monitoring wells, logging and sampling of 6 production wells, and sampling of sewers. Presents water quality results.
April 1988	Arizona Department of Environmental Quality. Air Toxics Monitoring Study of Phoenix Urban Area. April 1988. Presents findings of an air monitoring program conducted in and around the Phoenix metropolitan area.
April 1988	U.S. EPA. Technical Memorandum Installation of Phase II, Stage 2, Groundwater Monitoring Wells. Phoenix-Goodyear Airport RI/FS. Prepared by CH2M HILL. April 25, 1988. Discusses the installation of monitoring wells installed at the PGA site from March 15, 1987, to January 1988. Presents results of geophysical logging, aquifer testing, and water quality sampling.

Date of Publication	
August 1988	Unidynamics Phoenix, Inc. Results of the Phase II Groundwater Investigation. Unidynamics RI/FS. Prepared by Dames & Moore. August 2, 1988. Discusses installation of nine monitoring wells near the Unidynamics facility. Includes water quality data, water level data, and results of geophysical logging and aquifer testing.
December 1988	U.S. EPA. Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites. Office of Emergency and Remedial Response. December 1988. This guidance focuses on policy and decisionmaking issues associated with the development, evaluation, and selection of groundwater remedial actions at Superfund sites.
January 1989	Arizona Department of Health Services. Letter from Norman J. Peterson to Jess A. Brown. January 3, 1989. This letter explains the rationale and lists the ADHS health-based soil cleanup guidance levels for specific VOCs and pesticides.
June 1989	U.S. EPA. 9 volumes. Phoenix-Goodyear Airport Remedial Investigation/Feasibility Study. Public Comment Draft. Volumes I through VI prepared by CH2M HILL. Volumes VII and VIII prepared by Unidynamics Phoenix, Inc. Volume IX prepared by the Arizona Department of Water Resources. June 7, 1989. Presents the results of the remedial investigation and contaminant transport modeling efforts. Develops and evaluates alternatives for remedial action at the site.

Date of Publication	
June 1989	U.S. EPA. Reporter's Transcript of Proceedings Phoenix-Goodyear Airport Area Superfund Site Final Remedy. Prepared by Brush and Terrell, P.C. June 21, 1989. This is a transcript of the proceedings of the Public Meeting held by EPA on June 21, 1989, at 7:00 p.m. in the Goodyear Community Center to discuss the PGA final remedy.
July 1989	Unidynamics Phoenix, Inc. Letter from William Donahue to Mr. Jeff Rosenbloom, U.S. EPA, including attachments. July 17, 1989. Discusses technical issues associated with the EPA preferred alternative for the northern portion of the PGA site in the vicinity of the Unidynamics facility.
August 1989	Unidynamics Phoenix, Inc. Letter from Michele B. Corash, Counsel to Unidynamics to Hugh Barroll, Esq. and Jeff Rosenbloom, U.S. EPA, including attachments. August 1, 1989. Discusses legal issues associated with the EPA preferred alternative for the northern portion of the PGA site in the vicinity of the Unidynamics facility.
August 1989	U.S. EPA. Memorandum from CH2M HILL to EPA and the PGA Project Committee, including attachments. August 24, 1989. This memo includes an estimate of the mass of VOCs in the vadose zone and the estimate of migration of VOCs from the vadose zone to the groundwater.

Date of Publication	
August 1989	Unidynamics Phoenix, Inc. Letter from Michelle Corash, Counsel to Unidynamics Hugh Barroll, Esq., U.S. EPA. August 25, 1989. Discusses ARARs for the PGA Superfund site.
August 1989	State of Arizona. Letter from Linda Pollock, Assistant Attorney General to Hugh Barroll, Esq. and Jeff Rosenbloom, U.S. EPA. August 30, 1989, including an enclosure. Response to Unidynamics discussion of ARARs for the PGA Superfund site.
September 1989	U.S. EPA. Memorandum from CH2M Hill to EPA, including attachments. September 7, 1989. This memo presents responses to the Unidynmaics technical comments submitted July 17, 1989.
September 1989	U.S. EPA. Memorandum to the file, including attachments. September 22, 1989. This memorandum is a response to legal issues regarding the PGA Record of Decision.
September 1989	Record of Decision.
Currently being updated	CH2M Hill. Technical Data Management II computerized data base located in CH2M Hill's Phoenix and Redding offices. Contains all water elevation and quality data from ADHS, potential responsible parties, and EPA sampling. 1981-present

The following items are not included in the Administrative Record File since they are included in the "Compendium of CERCLA Response Selection Guidance Documents" located at EPA Region IX headquarters at 215 Fremont Street, San Francisco, California 94105.

Sept. 1984	U.S. EPA. Health Effects Assessment Documents. ORD, OHEA, ECAO. September 1, 1984.
October 1985	U.S. EPA. CERCLA Compliance with Other Environmental Statutes. Porter, J. W. Office of Solid Waste and Emergency Response. October 2, 1985.
Sept. 1986	U.S. EPA. Guidelines for Exposure Assessment. Federal Register. September 24, 1986, page 34042.
October 1986	U.S. EPA. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response. October 1, 1986.
December 1986	U.S. EPA. Interim Guidance on Superfund Selection of Remedy. Porter, J. W. Office of Solid Waste and Emergency Response. December 24, 1986.

Date of Publication	
May 1987	U.S. EPA. Final Guidance for the Coordination of ATSDR Health Assessment Activities with the Superfund Remedial Process. Porter, J. W. OSWER, OERR, ATSDR. May 14, 1987.
May 1987	U.S. EPA. EPA's Implementation of the Superfund Amendments and Reauthorization Act of 1986. Thomas, L. M. May 21, 1987.
July 1987	U.S. EPA. Alternate Concentration Limit Guidance Part 1, ACL Policy and Information Requirements. Office of Solid Waste, Waste Management Division. July 1, 1987.
April 1988	U.S. EPA. Superfund Exposure Assessment Manual. Office of Emergency and Remedial Response. April 1, 1988.

May 1988 — U.S. EPA. Interim Guidance on Potentially Responsible Party Participation in Remedial Investigations and Feasibility Studies. Porter, J. W. Office of Solid Waste and Emergency Response. May 16, 1988.

June 1988 — U.S. EPA. Community Relations in Superfund: A Handbook (Interim Version). Office of Emergency and Remedial Response. June 1, 1988.

August 1988 — U.S. EPA. CERCLA Compliance with Other Laws Manual. Office of Emergency and Remedial Response. August 8, 1988.

None — U.S. EPA. Integrated Risk Information System (IRIS). Office of Health Effects Assessment.

Appendix B
RESPONSE SUMMARY

Appendix B
RESPONSE SUMMARY

PHOENIX-GOODYEAR AIRPORT REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)

OVERVIEW

EPA received comments during the public comment period for the June 1989 Draft RI/FS report. The public comment period was held from June 7 through July 7, 1989. Comments were received from state agencies, potentially responsible parties, and members of the community. EPA also received comments at the Public Meeting held on June 21, 1989, at the Goodyear Community Center. All comments received are responded to herein.

COMMENTS AND EPA RESPONSES

COMMENTS FROM ADEQ

Volume I

1. CHAPTER 2, PAGE 2-27, PARAGRAPH 3

   In order to be consistent, provide the sampling depths for the results for Sludge Bed No. 2.

   RESPONSE

   The sampling results and depths for both sludge beds are presented in Figure 2-11 on page 2-29.

2. TABLE 2-8

   The soil volumes calculated in this table differ significantly from the volumes calculated by ICF Technologies, Inc., in the Chrome Sludge Drying Bed Feasibility Study. How were the volumes calculated? Provide a page of calculations or a description of the methodology utilized.

   RESPONSE

   Appendix K of PGA RI/FS details the methodology used to derive the soil volumes presented in Table 2-8. Only the EPA RI soil data were available at the time this

estimate was prepared. ICF Technologies, Inc., collected additional samples as part of their work at the sludge drying beds. They used this additional information to calculate their volume estimates. The only volume presented in the chrome sludge bed FS is for the soil contaminated above ADHS levels. ICF estimated this volume to be 4,800 cubic yards for soils above the chromium level. The estimate in the RI/FS is 2,200 cubic yards.

3. CHAPTER 2, PAGE 2-51, PARAGRAPH 6

Is there a possible explanation for the anomalously high value for cadmium in boring 21-EP-3?

RESPONSE

There could be a number of reasons for the cadmium value, but explanations at this point would be purely speculative. Data gathered during the RI suggest that outside of the area around the former sludge drying beds, cadmium is not a problem.

4. CHAPTER 2, PAGE 2-62, PARAGRAPH 4

Please describe the sanitary wastewater bed. Has it been referred to before? Is it the same as the existing wastewater ponds, or the sludge drying beds?

RESPONSE

The sanitary wastewater bed is an existing facility on the former GAC property. It is labeled as the wastewater sludge bed on Figure 1-7, page 1-21.

5. CHAPTER 3, PAGE 3-32, TABLE 3-10

The table repeats starting with well (B-1-1)16AAB5 (GMW-8) to the end of the table.

RESPONSE

Comment noted. The repetition has been removed from the table.

6. CHAPTER 3, PAGE 3-40, FIGURE 3-11

Carbon tetrachloride has been identified as a contaminant in the groundwater and in concentrations exceeding SDWA/MCLG. Should it be included in this table?

RESPONSE

Carbon tetrachloride is the seventh entry on the table.

7. CHAPTER 3, PAGE 3-41, TABLE 3-12

The title should read "Applicable or Relevant and Appropriate". The ARAR exceeded by chromium (total) is the MCL not the MCLG.

RESPONSE

Table 3-12 is revised to reflect these changes.

8. CHAPTER 3, PAGE 3-94, PARAGRAPH 5

There seems to be a disagreement between statements made here and on page 3-38, paragraph 5, as to the amount of discharge contributed by the MFU during pumping of well RID 5.6W, 3.5N.

RESPONSE

The amount of discharge contributed by the MFU during pumping of the well is more accurately stated as 25 percent as it is on page 3-94. Refer to pages O-547 to O-567 in Appendix O for a complete discussion, including the zones of water production, for well RID 5.6W, 3.5N.

9. CHAPTER 3, PAGE 3-110, TABLE 3-31

Table 3-3 indicates one well exceeds the ARAR TCE concentration of 5 µg/l but is not included in this listing.

RESPONSE

More than one well listed in Table 3-3 exceeds the ARAR value for TCE. None of these are appropriate to include in Table 3-31 since Table 3-31 is a listing of wells with unknown screened intervals that exceed detection limits for all contaminants. The information

presented in Table 3-3 is unrelated to information in Table 3-31.

Volume II

1. CHAPTER 5, PAGE 5-16, PARAGRAPH 5

What constitutes "significant" groundwater contamination? If only one monitoring well exists in the MFU, then how can a determination be made in relation to the impact of the site on the MFU? A brief discussion of the lack of data would clarify the statement that the MFU is "believed" to be free from adverse impact by the PGA site.

RESPONSE

The term "significant" as used here implies the contamination is high enough to cause adverse environmental or public health impacts or is above ARARs. The current data available on the MFU are limited, but include information from wells other than just the monitoring well. See pages 3-100 to 3-105 for a discussion of the MFU data gathered during the RI. It is not anticipated at this time that remedial actions for this unit will be required.

2. CHAPTER 5, FIGURE 5-1

Inconsistencies exist between this figure and the supporting text for identification and screening of technologies for soils. Typographical errors are common in this figure.

Biological treatment as a remedial technology has been screened out, yet the figure indicates that it is potentially viable. An additional comment to support the decision to drop the alternative from further consideration would be beneficial.

The figure indicates that removal of soils is potentially viable but the alternative is not discussed in the text.

RESPONSE

The typographical errors are corrected on the figure. The figure correctly shows biological treatment as being screened out. The screening comments are changed

to reflect that biological treatment is not a proven technology for use with the contaminants present at the site. The excavation technology is retained for further analysis and is discussed in Chapter 6 in the development of alternatives.

3. CHAPTER 5, FIGURE 5-2, GROUNDWATER END USE

RECHARGE/REINJECTION

In accordance with the Environmental Quality Act, Title Section 49-243.B.2 and 3, subsurface and surface discharges cannot degrade an aquifer that is protected for drinking water use. Since the Environmental Quality Act protects all aquifers for drinking water use (A.R.S. Title Section 49-224.B.), treated water would be required to meet drinking water standards or aquifer water quality standards prior to recharge or reinjection. Further, if the water is reinjected or recharged offsite (outside the study area boundaries) then an Aquifer Protection Permit/Groundwater Quality Protection Permit will be required for the activity.

DISTILLATION & EVAPORATION

Any additional comments supporting the screening out of distillation and evaporation would be helpful.

RESPONSE

If reinjection is part of the selected remedy, then the appropriate treatment levels will be required. Pages 5-32 and 5-34 expand on the reasons behind the screening of the distillation and evaporation option.

4. CHAPTER 5, PAGE 5-23, PARAGRAPH 5

Also note that if the treatment alternative results in increased concentrations of constituents (i.e., higher TDS), then the treated water could not be re-introduced to the aquifer. (In accordance with A.R.S. Title Section 49-243.B.2 and 3, the aquifer cannot be degraded with respect to aquifer water quality standards.)

RESPONSE

The paragraph states that no degradation of aquifer quality is acceptable.

5. CHAPTER 5, FIGURE 5-3

In order to meet the substantive requirements of the Aquifer Protection Permit/Groundwater Quality Protection Permit Program, in-flow and out-flow meters might be required on the system to measure and record quantities of treated water.

RESPONSE

These items may be included during the remedial design phase. No change to Figure 5-3 has been made.

6. CHAPTER 5, PAGE 5-28, PARAGRAPH 3

Could air-stripping result in a waste stream from accumulation of scaling deposits or from precipitate formation? If so, this could be an added disadvantage.

RESPONSE

The text does refer to the possibility that cleaning of scaling and/or deposits may be required. This would likely create a waste stream requiring disposal but the nature of the waste stream and the problems associated with disposal cannot be predicted without actual field operating experience.

7. CHAPTER 5, PAGE 5-28, PARAGRAPH 5

Is the handling of spent carbon prior to disposal or regeneration a potential hazard? Would the material be regulated by the Resource, Conservation and Recovery Act (RCRA) (See #14)?

RESPONSE

Handling of spent carbon could present a hazard and would require the same health and safety procedures as handling of other hazardous wastes. However proper design can minimize the handling required. The spent carbon would be regulated under RCRA since it would contain a listed hazardous waste.

8. CHAPTER 5, PAGE 5-31

Capping alternatives are broken down into costs. Why wasn't the same approach used for the treatment alternatives?

RESPONSE

Capping is not discussed on page 5-31. Page 5-31 discusses treatment technologies for groundwater. No costs are given in Chapter 5 for any technologies. Chapter 6 provides relative costs for all alternatives. Order-of-magnitude cost estimates for the alternatives are provided in Chapters 7, 8, 9, and 10.

9. CHAPTER 5, PAGE 5-31, PARAGRAPH 3

Does bed backwashing generate a waste stream? If so, please discuss the possible ramifications.

RESPONSE

Backwashing may be required if suspended solids in the influent water are high enough to build up over the life of the carbon bed such that they plug the bed prior to exhausting the carbon capacity. Backwashing of the bed is usually avoided if possible either through careful sizing of the bed or through installation of a separate upstream filter.

Any suspended solids collected would be a waste stream requiring disposal. Generally, the suspended solids would consist of clay and silt particles which may or may not retain detectable quantities of contaminants. The disposition of the waste cannot be determined without actual field operating experience.

10. CHAPTER 5, PAGE 5-37

It seems reasonable to combine reverse osmosis with other treatment methods to remove chromium.

RESPONSE

Chromium concentrations can be reduced using reverse osmosis and other treatment techniques; however, there is no apparent need to treat chromium at the site above and beyond the Section 16 Operable Unit Remedial Action.

11. CHAPTER 6, PAGE 6-25, PARAGRAPH 3

This section evaluates chemical-specific ARARs. Do any action- or location-specific ARARs apply to potential remedial actions for groundwater? (For example,

remedial actions performed "onsite" are only required to satisfy the substantive requirements of permits. If, however, water were to be recharged outside the study area boundaries, then the CERCLA permit exemption would no longer apply and an Aquifer Protection Permit/Groundwater Quality Protection Permit would be required for the activity.)

RESPONSE

There are action- and location-specific ARARs for all the potential remedial action alternatives. A complete evaluation of ARARs appears in Appendix I. Only the chemical-specific ARARs are discussed on page 6-25 since they are pertinent to the discussions defining target areas which follow in Chapter 6.

12. CHAPTER 7, PAGE 7-8, PARAGRAPH 2

It would be expected that the estimated total mass of VOCs in the soils for Target Area 2 should be greater than that for Target Area 1 and less than Target Area 3. Is the 104,400 pounds correct?

RESPONSE

Page 7-8 of the Public Comment Draft RI/FS is the back of Figure 7-3 and has no text. Page 7-18 of a previous draft (Project Committee Draft, March 1989) contained an error in the estimated mass of VOCs present in Target Area 2. This error was corrected, but estimated masses of VOCs for each target area were not included in the Public Comment Draft. This was done since the total estimate of VOC mass in the vadose zone is being revised based on discussions with the PGA Project Committee. Revised mass estimates will be distributed to the project committee when they are available.

13. CHAPTER 7, PAGE 7-16, PARAGRAPH 6

Are carbon regeneration facilities subject to RCRA or Air Quality regulations?

RESPONSE

Generally, Superfund sites are exempt from obtaining permits for operation within the site boundaries; however, they must comply with the substance of the law.

Offsite discharges do require that all necessary permits and regulations be obtained.

Specifically, any onsite carbon regeneration facility would need to comply with the provisions of RCRA if the spent carbon were determined to be a listed hazardous waste, as is expected, but would not need to be permitted as a TSD facility. Any air emissions from the facility would have to comply with all federal, state, and local air quality regulations and would also have to meet all permitting and monitoring requirements.

14. CHAPTER 7, PAGE 7-28, PARAGRAPH 2

The ponds should be examined to determine if leakage and infiltration are occurring regardless of the soils alternative selected.

RESPONSE

The area around the former sludge drying beds, including the ponds, is being considered separately for remedial action. Goodyear Tire and Rubber is conducting that work. It is agreed that pond liner integrity must be assessed regardless of the remedial action chosen, and that the ponds may have an effect on the sitewide soils and groundwater remedial actions. Therefore, there is a strong interest to determine that the ponds are not leaking and allowing infiltration. These concerns have been expressed to Goodyear during review of their chromium sludge bed FS.

15. CHAPTER 7, PAGE 7-44

Should this be labeled as Table 7-9 not 7-1?

RESPONSE

Yes. Table number is revised.

16. CHAPTER 7, TABLE 7-8 AND 7-9

Capital costs calculated in Table 7-9 are not the same as those listed in Table 7-8. Why do these differ?

RESPONSE

Capital costs listed in Table 7-9 are only the estimated construction costs. Table 7-8 lists the total

capital costs which include construction, mobilization/demobilization, permitting and legal, bid and scope contingencies, services during construction, and engineering and design costs.

17. CHAPTER 8, FIGURES 8-10, 8-12, AND TABLE 8-2

Calculations of rates of aquifer restoration to ARAR concentrations indicate remedial action Alternative 4 is more effective than Alternatives 5 and 6 which utilize more wells. This suggests that the location of the new extraction wells has more of an impact on the clean-up time than the number of wells.

RESPONSE

Alternatives 5 and 6 were developed for the restoration of the aquifer to background concentrations. This requires extraction of a larger volume of water than required to restore the aquifer to ARARs. The wells considered in Alternatives 5 and 6 were placed to achieve capture of this larger volume of water. The figures show that Alternatives 5 and 6 are effective for the ARAR target area, but not as effective as Alternative 4, which was developed specifically for restoration of the aquifer to ARARs. It is not appropriate to draw conclusions about extraction impacts by comparing Alternatives 5 and 6 to 3 and 4 since they were developed for different target areas.

18. CHAPTER 8, PAGES 8-40, 8-41, TABLE 8-6

TIME UNTIL PROTECTION IS ACHIEVED

The time required to reduce the contaminant levels in the aquifer to below ARAR concentrations for Alternatives 4, 5, and 6 is incorrect. Table 8-5 and Figures 8-10 and 8-12 indicate time is 38, 65, and 40 years, respectively.

RESPONSE

Table 8-6 has been revised to correct the typographical error.

19. CHAPTER 8, PAGE 8-4, TABLE 8-6

PERMANENT AND SIGNIFICANT REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

The above comment applies to this table as well.

RESPONSE

Table 8-6 has been revised.

20. CHAPTER 9, TABLE 9-10

How were flow rates derived for Alternatives 3 and 4 for contamination greater than background?

RESPONSE

There are no flow rates presented for Alternatives 3 and 4 for contamination greater than background. Alternatives 3 and 4 are developed for the contamination above ARARs target area only.

21. CHAPTER 10, PAGE 10-12, PARAGRAPH 5

What is EBCT?

RESPONSE

EBCT refers to Empty Bed Contact Time which is a design parameter for liquid phase activated carbon vessels.

22. CHAPTER 10, TABLE 10-11 AND TABLE 10-12

These tables appear to be incomplete. Often no comments appear for Alternatives 4, 5, 6.

RESPONSE

The tables will be revised to include comments for the other alternatives.

23. APPENDIX J, PAGE J-3, FIRST EQUATION

The term should be $2S-_x$ not $25-_x$.

RESPONSE

The term has been revised.

24. APPENDIX R, PAGE R-44, PARAGRAPH 3

Figure R-3 does not show TCE or chromium concentrations as referenced.

RESPONSE

The figure has been revised to show the areas.

25. APPENDIX S, PAGE S-29, PARAGRAPH 2

Where are Figures 9 and 10?

RESPONSE

Figures 9 and 10 are included on pages 24 and 25 of Appendix S.

26. APPENDIX S, PAGE S-68

Upon examination of Figure 43, it appears that carbon capacity at a TCE concentration of 920 µg/l and a temperature of 185 degrees Fahrenheit is greater than 10 percent by mass.

RESPONSE

While the graph is subject to interpolation error, it appears that the 8 percent by mass capacity referred to in the text on page 68 is approximately correct.

27. APPENDIX S, SUB-APPENDICES B & C

The Summary of Pressure and Flow Measurements and the Summary of Concentration Measurements are not labeled with page numbers. This makes reference to the tables and data difficult.

RESPONSE

Page numbers will be added to the appendixes in the final RI/FS.

COMMENTS FROM E. A. WOOTON

If carbon absorption is used to clean the fouled water placed in and around Goodyear, then:

- What is to be done with the polluted carbon material?
- Where is it to be stored to eventually corrupt that area?
- What is the "life" of this pollutant before nature neutralizes it?

It would appear that the Soil Vapor Extraction will pollute the surrounding air of this valley.

- What amount of pollution will this method add to the problems we already have in this area?
- As one who has asthma and is already concerned about pollution, it seems to me that every effort should be made to protect the citizens as completely as possible.
- Cost should not be the first concern.

RESPONSE

This comment appears to address two concerns. The first has to do with the fate of any activated carbon that may be used onsite. The second has to do with the disposition of the vapor from the SVE system, whether it is treated, and any possible health effects resulting from the discharge.

If activated carbon is used onsite, there are three possible options for disposal of the spent material. The first is landfilling. In this case, the spent carbon would be properly packaged and shipped to an approved disposal site which is in conformance with all current restrictions on the disposal of hazardous waste. Generally, this is only economical if small amounts of carbon are used. The carbon would also be subject to EPA's land ban restrictions issued under RCRA which may make this option unfeasible if the concentrations of contaminants exceed the limits imposed under the regulations.

The second option is regeneration of the spent carbon. This option entails removing the contamination from the

carbon so that the carbon can be reused. The contamination that is removed is either recovered for reuse or destroyed through incineration. This option could be implemented onsite or offsite depending on economics and other factors. The third option is incineration of the spent carbon. This means the carbon and contamination are both destroyed in an incinerator.

The alternative chosen will be protective of human health and the environment and will depend on the quantity of carbon used, the concentrations of contaminant on the carbon, and the relative costs of the options. An analysis to determine the final disposition of the carbon would be done as part of the design of the remedial action.

Soil vapor extraction as proposed in the RI/FS includes installation of activated carbon to reduce emissions to the atmosphere. The concentrations of contaminants at the outlet of the two bed carbon units proposed will normally be nondetectable. Thus, the health risk posed in the ambient air by the soil vapor extraction unit will be negligible.

RESPONSES TO GOODYEAR TIRE AND RUBBER COMPANY'S LETTER DATED JULY 6, 1989

(Letter attached at back of this appendix)

RESPONSE TO PAGE 2, 3RD PARAGRAPH

The June 7, 1989, Public Comment Draft RI/FS did contain ADWR's model as Volume IX, Appendix V. Nonetheless, Goodyear states they received the model in late May and they will exercise their right to comment on it within 3 weeks of its receipt. The 3 weeks expired prior to the date of their letter.

RESPONSE TO SECTION ON "TCE RESIDUALS IN SOIL"

Goodyear states that the mass estimate for TCE in the vadose zone is wrong for several reasons. It is agreed that the method used to estimate the VOC mass in the soil is subject to much uncertainty. Due to soil and contamination heterogeneities, the dynamic nature of transport phenomena in the vadose zone, and the difficulty in defining the necessary parameters, among other things, the calculation of mass in the vadose zone will always be merely an estimate. However, the Goodyear assertion that the mass is only 20,000 to 30,000 pounds is not accompanied by any calculations, so we cannot assess its validity. The fact remains, based on soil gas and soil data, that significant contamination continues to reside in the vadose zone.

Goodyear asserts that contaminant equilibrium is not attained in the soil at the site but offers no reasons supporting this conclusion. While the vadose zone conditions will constantly change with varying recharge, barometric pressure changes, temperature fluctuations, etc., the system is likely to attain a rough equilibrium. The method used in the RI/FS is the best estimate obtainable of those conditions, and to our knowledge there is no reason to believe that they significantly vary from equilibrium.

Goodyear asserts that the organic carbon fraction (foc) in the soils and therefore the partition coefficient Kd should both be 0.0 since apparently ADWR used this value in its model. The foc used in the mass estimate is based on the average organic fraction actually measured in soil samples from the site. These data are shown in Table B-1 of Appendix S of the RI/FS. The value is not 0.0 but approximately 500 mg/kg. It should also be noted that while use of this value increased the total mass in the vadose zone to

some degree, it also reduces the effect of recharge by estimating contaminant retardation.

It is agreed that the best approach to vadose zone remediation is to formulate a plan for evaluating the field conditions as they are encountered. The problems that this approach creates relate to the residual level of contamination that is acceptable (how clean is clean?) and how do you measure them. This decision will also relate to the target areas chosen for remediation. The decision tree offered by Goodyear is a good start but leaves several questions unanswered relating to prediction of the threat of residual contamination and the measurement technique used to determine compliance. Goodyear also states that drawing contamination up from the groundwater is an undesired result from the SVE system. Since removing contamination from the PGA site is the desired result and the SVE system will accomplish this, it is difficult to see why drawing contamination from the groundwater into the SVE system is undesired.

RESPONSE TO SECTION ON "GROUNDWATER"

Goodyear inaccurately restates the groundwater pumping alternatives. Page 8-13 of the Public Comment Draft RI/FS includes a description of the pumping alternatives evaluated. None of the alternatives include pumping of existing wells at an accelerated rate. Pumping rates for existing wells are based on annual average pumping rates obtained from ADWR records.

As presented in Chapter 8 of the RI/FS, the alternative that considers pumping at an average rate from only existing wells is ineffective at meeting the remedial response objectives.

The Subunit A remedy will <u>not</u> eliminate contamination in Subunits B and C.

The fact that the ADWR model was not used to evaluate the groundwater alternatives does not mean that the evaluation is "flawed." See the responses to technical comments Numbers 12 and 14 for further discussion on this issue. The techniques used for determining the hydraulic head in the aquifer for various alternatives are based on valid and accepted hydrogeologic formulas.

Reinjection is not the only end use considered. An entire chapter of the RI/FS deals with alternative end uses for treated groundwater.

Goodyear also presents data in support of installing air stripping without vapor phase carbon treatment on the overhead air stream. While these data will be factored into the decision regarding treatment of the air effluent, they are not the only data that must be considered. Other factors include SARAs mandate on reducing contaminant toxicity, mobility, and volume, other public comments regarding the site, and the air quality in the Phoenix area, which is currently a non-attainment area for ozone precursors such as those emitted by the proposed air strippers.

ATTACHMENT A TO GOODYEAR TIRE AND
RUBBER COMPANY'S LETTER DATED JULY 6, 1989
TECHNICAL COMMENTS

1. PAGE 2-37

The discussion of metals in soil encompasses all metal data generated regardless of the probable source of the metal or background levels in the area of the PGA. This discussion is particularly misleading with respect to arsenic since natural arsenic levels are sufficiently high to generate risk levels of concern and there is no record of use of arsenic onsite. The failure to segregate site-related contaminants from naturally occurring ones results in soil ingestion risks being driven by arsenic which cannot be remedied since it is ubiquitous in the native soil. A few statements to this effect would prevent the reader from being misled about site-related risks.

RESPONSE

It seems appropriate to include all data generated during the RI in the RI/FS report. Pages 2-40 through 2-54 include discussions of site-related contaminants and background concentrations for contaminants. These pages should eliminate any confusion about site-related risks.

2. PAGE 2-40

No attempt has been made to differentiate Cr(III) from Cr(VI) or leachable chromium from fixed or insoluble chromium. As a consequence, total chromium values are reported and used for the purposes of estimating public health impacts even though availability and valence state greatly affect the nature and magnitude of risks.

RESPONSE

Appendix G contains results of some sequential extraction tests done on samples containing chromium in excess of background levels.

As stated in the endangerment assessment, risks were calculated conservatively by assuming that all of the chromium was Chromium VI. However, in areas outside the former sludge beds (which are the areas of concern

in this FS), even this conservative approach yielded no significant health risks. The areas in and around the former sludge beds are being handled by Goodyear under an Administrative Order on Consent and were not included in this RI/FS. Calculating risks for the soils considered in this FS based on Chromium VI values (which will not exceed total chromium values) will only shown a smaller risk, but the risk has already been shown to be insignificant.

3. PAGE 2-54

An estimate of the inventory of TCE in soil of 450 lbs was made from existing soil boring data. When an amount equal to this was removed during pilot soil evacuation work, a second estimate was attempted using soil vapor data. The latter estimate came to as much as 115,000 lbs depending on the assumptions made with respect to vertical distribution of TCE residuals. The algorithm used to calculate total soil TCE mass from soil vapor data relies on an assumed equilibrium condition between soil-sorbed TCE, water-bound TCE, and soil vapors.

For simplification, a single partition value was used to calculate soil/water ratios. This value was also used in conjunction with the Henry's law constant to predict soil/vapor ratios. The partition value selected was based on a prescribed soil organic level. Use of any value other than 0.0 contradicts the assumptions made by the Arizona Department of Water Resources (ADWR) in preparing the groundwater model for the site. While the ADWR assumption is probably overly conservative, an assumed constant value throughout a 60-foot depth is also misleading. It is highly likely that deep sands and gravels will have little or no affinity for the TCE. Hence, use of the algorithm will overpredict soil-bound TCE from the existing TCE vapor data.

The likelihood of overprediction is illustrated by analysis of the existing data. The highest soil vapor values were found in the area of the soccer field. Borings in that same area revealed no measurable TCE in subsoils. Hence, the algorithm is assigning TCE at significant concentrations to soils that have no evidence of contamination. Similarly, soil vapor readings from the area of the Phillips well were as high as 1.7 µg/l even through this property is 3 miles from the

site. These vapor levels are either derived from other sources or reflect the groundwater plume at that point. There is no evidence that they are associated with soil contamination.

RESPONSE

As stated previously, there are shortcomings to the method used to predict the total TCE mass. Actual soil data confirm that the organic content fraction in the soil is lower than the assumed average at depth but also that it is higher than average at the surface. The assertion that this makes the prediction less accurate is not clear.

It also is true as alluded to in the comment that soil gas readings can be an indicator of a groundwater plume as well as an indicator of a soil contamination source area. However, any presence of contaminants in soil gas is an indication of environmental degradation however small. It should also be noted that sampling and measurement of soils for the presence of contaminants is subject to error through excessive handling and volatilization. Only upon reviewing the data in total can a determination be made of source and nonsource areas and a prediction made of the effectiveness of remedial action.

4. PAGE 2-61

Calculations are made to estimate the total volume of soil in excess of Arizona Department of Health Services (ADHS) soil action levels. These volumes are meant for use in determining the cost of remedial action. The volumes are misleading, however, since they encompass all soils and subsoils with VOC concentrations in excess of the action level. The action level was devised for surface soils, not deep subsoils. Most TCE residuals lie 20 to 30 feet below the surface. Alternate action levels are needed for these soils on the basis of their ability to affect groundwater quality.

RESPONSE

To our knowledge, the ADEQ action levels are health-based but apply to all soils and are not restricted as to the depth over which they apply. While a determination of which soils are a threat to

groundwater is a good way of defining target areas, this is difficult in practice. The target areas in the RI/FS were chosen as a means of defining order-of-magnitude costs. At this time, target areas for soils remediation are under discussion and are likely to change from those in the RI/FS prior to issuance of the ROD.

5. PAGE 2-61

Vadose zone calculations are made suggesting that 16,000 lbs of TCE will move to the groundwater in 20 years. These calculations are based on an assumed recharge that is without documentation. They also appear to take no recognition of unsaturated zone transport times. Using EPA time-of-travel algorithms, recharge at 0.32 in/yr would take 117 years to move 20 feet downwind under current conditions. If the TCE has a partition coefficient of 0.49 l/kg, its travel time would be retarded by a factor of 2.6 and hence would be 304 years.

RESPONSE

Recharge is estimated based on our knowledge of annual precipitation, ambient temperatures, estimated evapo-transpiration, and runoff. The fact that contaminants have in fact traveled through the vadose zone to the groundwater is evidence that some recharge occurs at the site. 0.32 in/yr was chosen as a reasonable estimate but it is only an estimate. Currently, the leaching of contaminants to the groundwater table is being recalculated and the time over which recharge occurs will likely be revised.

6. PAGE 3-46

The risk calculations are based on current TCE concentrations at various wells around the PGA site. No attempt was made to use the ADWR model to see how those concentrations will change over time. Since cancer risks are based on 70 years of exposure, the assumption is tantamount to saying that the groundwater at any one well will not see any appreciable change in TCE concentrations over a 70-year period. That is unrealistic. Simple application of plume size and the estimated velocities in the affected aquifer suggest that concentrations will drop an order-of-magnitude in 7 years. If that does occur, the actual risk at the

site will be one tenth that predicted in the RI/FS. The analysis also fails to consider the effects of the Operable Unit 16 remedy which is currently under construction.

RESPONSE

Pages R-139 and R-140 in Appendix R discuss the risks for various scenarios under the no action alternative. Future concentrations under the no action alternative were estimated by ADWR with their model. The Section 16 OU remedy was included.

7. PAGE 3-46

Well logs from construction of extraction and injection wells for the Operable Unit 16 remedy suggest that the boundaries between Subunits A, B, and C are not always distinct and then in some areas, the units may be indistinguishable. Previous descriptions imply rather clear cut interfaces which is misleading.

RESPONSE

CH2M HILL is willing to assist Goodyear in interpreting well logs and serve as a resource of hydrogeologic data which has been compiled over the last 5 years.

8. PAGE 4-1

Risk estimates for suspended particulate are based on current emission rates being sustained over a 70-year period. A simple calculation shows that in a period of 7 years, the finer suspendable particles will be depleted to a depth of 1.5 cm. This in effect will leave the larger, nonsuspendable particles to armor the surface and minimize further resuspension. As a consequence, risks will actually be an order of magnitude less than predicted. The bulk of the risk from suspended particles is attributable to arsenic in the soil. Since arsenic is naturally present and not a site-related contaminant, the risk calculations provide a misleading picture of incremental risk and risks that can be addressed by a site remedy. All soils in the area pose the same level of arsenic driven risk.

RESPONSE

The risks were estimated using the most conservative scenario. No backup is given for the calculation showing a depletion of finer particles in 7 years, but data from soil samples show silt contents of 60 to 70 percent in surface soils.

The bottom line is that risks calculated using the conservative approach are not significant for the soils considered in this RI/FS; therefore, using a less conservative approach will not change the conclusions.

9. PAGE 5-41

The ultraviolet-ozone oxidation process is dismissed prematurely. Recent studies show this process to be very effective in removing organic contaminants from water. In areas where air stripper emissions must be treated with carbon, the UV-ozone process can be cost competitive.

RESPONSE

To our knowledge UV-ozone type treatment has not been proven commercially for treating halocarbons such as those found at the site. In addition, the relatively high TDS levels may make this option unattractive. In the presence of a proven low cost alternative such as air stripping, use of a new technology is unwarranted without further study.

10. PAGE 6-13

Target Area 1 is inappropriate. ADHS action levels were designed to address surface soils, not subsoils 20 to 30 feet beneath the surface. If a target area is to be defined using ADHS action levels, it should be based solely on TCE concentrations in surface soils.

Target Area 3 is not based on any defensible rationale. No attempt is made to relate soil vapor concentrations to site risk values. Since soil vapor results do not correspond with subsoil concentrations of TCE, the use of soil vapor to delineate a target area is illogical. At a minimum soil vapor values should be converted to equivalent soil concentrations and the target area defined on the basis of the latter.

RESPONSE

The ARAR analysis identified a lack of cleanup criteria or standards to be applied to the contaminated soils in the vadose zone. In the absence of ARARs or other criteria, EPA is to select a cost-effective remedial action that meets the remedial response objectives, unless meeting the objectives is not feasible. To allow the selection of a cost-effective action, a range of action levels was evaluated and the costs and benefits of each were identified. Target Area 1 was developed based on the ADHS action levels and is considered the area containing the most significant amounts of contamination at the site. Target Area 3 is considered to be the area encompassing all contamination in the vadose zone as a result of site-related activities.

11. PAGE 6-21

The discussion of the capping alternative appears to contradict other portions of the RI/FS. The implication of this discussion is that recharge is insignificant with respect to TCE movement. And yet, the calculations of vadose zone movement and soil residual effects on groundwater quality are based on a prescribed recharge rate of 0.32 in/year. Either recharge is driving TCE downward and capping will minimize or prevent this migration, or recharge is insignificant and subsoil contamination can be left in place without remedy.

RESPONSE

The implication of this discussion is that the existing paved areas are not adequate caps. A properly designed cap will minimize infiltration and leaching of contaminants.

12. PAGE 8-2

A very simplistic analysis is employed to calculate aquifer flushing times. This is difficult to explain since a great deal of money has been spent developing a sophisticated groundwater model to predict flushing times and plume movement. The RI/FS should rely on model results for flow and transport predictions.

RESPONSE

In our opinion, the analysis performed in the FS is appropriate for the task of developing and evaluating conceptual alternatives for the project. The goal of the analysis is not to predict the actual times for flushing the aquifer of contaminants but rather to evaluate the relative difference in flushing times between the several alternatives. Evaluation using the solute transport model developed by ADWR would cost considerably more than the method used but would not provide any additional accuracy in prediction of the rate of flushing. This is because the model does not account for the slow rate of flushing from the aquifer. Rather, the model assumes that contaminants move in piston flow. This assumption results in the inaccurate conclusion that the aquifer is flushed after only one pore volume is extracted.

13. FIGURE 8-3

The contaminant plumes have been depicted as large areas joining points wherever VOCs were detected in groundwater without regard to the relative concentrations at adjoining wells. Geostatistical analysis should be used to prepare these plots. The relatively high values at the Phillips well and lower concentrations at points between Phillips and the site open the possibility of multiple sources or a more concentrated transient plume that is passing by Phillips to be followed by water of better quality. Since risk was estimated on the basis of continued exposure to current levels, a better characterization of the actual plume could have a big impact on conclusions concerning risk and the nature of required remedies.

RESPONSE

The target areas for remediation are based on the available data on the actual distribution of contamination in the aquifer. For the purpose of developing and evaluating alternative remedial actions, it was conservatively assumed that the target areas should encompass the entire area that is bounded by observed contamination in groundwater. It may be that the actual distribution of groundwater contamination differs from the target area. However, without actual field data showing that an area is clean, we believe that it is appropriate to assume that it should be

included in the target. Geostatistical analysis of the data is not reliable enough to reduce the size of the target areas for remediating. After additional monitoring and extraction wells are drilled, modifications to the target area for remediation can be developed.

14. PAGE 8-30

Simple equations are applied to estimate groundwater travel times. The ADWR model was developed to provide much more accurate predictions of travel times and should be employed for that purpose.

RESPONSE

See response to Comment 12.

15. PAGE 8-36

A simplified approach is taken to calculate the time required to achieve cleanup. Once again, the ADWR model should be employed for this purpose. Furthermore, the estimates do not consider implementation of the Operable Unit 16 remedy or continued inputs from the vadose zone. This static evaluation of aquifer cleansing is unrealistic.

RESPONSE

Additional evaluation of the impact of the vadose zone in prolonging the cleanup is currently in progress. These calculations suggest that if the vadose zone is not flushed of contaminants, then the cleanup times could extend for hundreds of years. In the evaluation of the alternative in the FS, it was assumed that the vadose zone would not be a continuing source of contamination. Likewise, in the evaluation, it was assumed that contaminants from Subunit A would no longer be moving to Subunit C. This assumption implicitly includes to the Section 16 Operable Unit.

16. PAGE 9-7

The analysis of end use options for the treated groundwater does not give ample consideration to problems associated with water rights. A brief discussion is given of water rights after discharge. However, it is not clear if the water is currently owned by a party who can subsequently dictate where the

treated water should go. If the City of Phoenix or some similar entity owns the groundwater, they may not allow it to be delivered for private or public use by other entities. A much more thorough evaluation of ownership is required before discharge alternatives can be considered.

RESPONSE

The thorough evaluation of ownership and water rights can be evaluated during remedial design. Presently, the preferred alternative is to provide the water to the current users of the existing wells. Additional water from new extraction wells may be provided to the City of Goodyear for municipal use.

17. PAGE 10-1

The options for design of the groundwater extraction system should be evaluated using the available models of the local groundwater. A simple water balance approach fails to consider the Operable Unit 16 remedy and the complexities of the aquifer. With sophisticated tools readily available to support the analysis, reliance on simple approaches is indefensible.

RESPONSE

See responses to Comments 12 through 15.

PAMELA SWIFT

I'm still very concerned about the health problems here and of the employees that used to work here. So once again, this is the fourth time they have been here and the fourth time I've requested for health surveys. I do not want to see air stripping because of our air quality laws. And even if we didn't have that, when these chemicals are mixed with other chemicals that are being emitted mostly at night from our industries here, I think it's very dangerous. We do have inversion here, so that's going to be very harmful if there's any of the air stripping.

Also, since it appears that Goodyear and EPA has their mind made up to go ahead with the air stripping, because it is cost-effective, it's not health-effective, but it's cost-effective -- I would hope that they would put scrubbers on, which I doubt if they will because scrubbers are very expensive. But I do not want to see air stripping, and I think it's going to be very dangerous for us to do that. Thank you.

RESPONSE

Health surveys are typically conducted by agencies other than EPA such as the Agency for Toxic Substance and Disease Registry (ATSDR). Please contact Ms. Gwen Eng at ATSDR for more information.

The air-stripping alternative for treatment of VOCs will be well below all applicable air quality standards for emissions. The current estimates are that approximately one pound per day or less of VOCs will be emitted from the air strippers. These low emission rates will be insignificant to the ambient air quality, and no additional threat to public health will be incurred.

If "scrubbers" or vapor phase emission controls are added to the stripping towers, the treatment cost will be doubled or tripled and an additional hazardous waste will have to be dealt with. The activated carbon used to remove VOCs from the airstream will require disposal or destruction through incineration. Given the disadvantages of a significant increase in cost and the required handling of a generated waste, it is not feasible to add emission controls to the

air strippers which are already deemed protective of human health.

MIKE BOONE

I'm for cleaning up the environment. I've lived in Arizona all my life, and I'm very concerned about the environment. I love the outdoors. And I think that we need to do all we can to clean it up and for the future and for the present.

But I would be opposed to any type of emissions put into our air unless you're certain that it won't affect the people in the town of Goodyear and Avondale. Other than that, I think it's a good plan, and I support it.

RESPONSE

See response to Pamela Swift.

DENNIS MYERS

F.A.A. will respond with written correspondence during the allotted time.

COMMENTS FROM FEDERAL AVIATION ADMINISTRATION AND RESPONSES

1. During transportation of the contaminated soil, ensure that the contractor(s) wet or cover the soil in the vehicles to prevent wind blowing contaminated dust toward the air traffic control tower (ATCT).

   RESPONSE

   If contaminated soil is transported, Department of Transportation regulations will be followed to cover the soil and mitigate dust.

2. Provide dust control for vehicle traffic south and west of the ATCT on the unpaved roads and dirt areas.

   RESPONSE

   The surface soils are not contaminated except those near the former GAC sludge drying beds which do not receive vehicle traffic.

3. Brief Air Traffic Manager on any emergency procedures and contingency plans concerning site cleanup.

RESPONSE

This can be done at the beginning of remedial activities. Goodyear Tire and Rubber should perform this task for the Section 16 remedial action.

4. We are concerned as to the locations of the air strippers in relation to the ATCT, as we have an average of seven employees on duty during a typical day shift, working 75 feet above grade at the cab level and may be exposed to high concentrations of VOCs. According to your statement at the June 21 meeting in Goodyear, you thought the air stripper towers would reach a height of 40 feet. Our employees would be 30 feet above that.

RESPONSE

Goodyear Tire and Rubber should address this concern for the Section 16 remedial action. To determine the exposure of employees in the tower from the air stripping conducted during the final remedy, several factors must be considered: treatment plant location, emission rates from the stripping towers, and the source of the air supply into the air traffic control tower. More precise information concerning these factors will be gathered during the remedial design phase and a more accurate assessment can be made at that time.

ARIZONA
DEPARTMENT
OF WATER
RESOURCES

Rose Mofford, Governor
N. W. Plummer
Director

15 South 15th Avenue
Phoenix, Arizona 85007

August 3, 1989

Mr. Jeff Rosenbloom
PGA Project Manager
US Environmental Protection Agency
Mail Code T-4-2
215 Freemont Street
San Francisco, California 94105

Dear Jeff:

Here is the responsiveness summary for the Three-Dimensional Contaminant Transport Modeling Report otherwise known as Appendix V, Volume IX of the PGA RI/FS report. I have received and addressed comments from the Arizona Department of Water Resources and CH2MHILL. These are the only comments that I have received at this time. The responsiveness summary follows the same format as the responsiveness summary included in the Public Comment Draft of the RI/FS report.

You will be receiving several quarterly reports to the present quarter by the end of the month. If there are any other administrative tasks that need to be taken care of for this site please let me know.

If you have any questions or need additional information, regarding the responsiveness summary, please do not hesitate to call me at (602)542-1586.

Thank you.

With Best Regards,

Greg L. Bushner

Greg L. Bushner
Hydrologist

GB/rb

RESPONSE TO WRITTEN COMMENTS RECEIVED ON
JUNE 1989 PUBLIC COMMENT DRAFT
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
PHOENIX-GOODYEAR AIRPORT

Written comments on the public comment draft Volume IX were received from the following parties:

- Arizona Department of Environmental Quality
- CH_2M-Hill (Peter Mock)

Because of the wide variety of numbering styles used on comments submitted and for ease in future references, the comments have been numbered consecutively, from Comment No. 1 through Comment No. 80. All comments received which relate to Appendix V - Three-Dimensional Contaminant Transport Model prepared by the Arizona Department of Water Resources have been included in their entirety.

COMMENT 1 (ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY)

Volume IX- ADWR 3-D Contaminant Transport Model

Overall, the report is thorough and well documented, however, the figures are difficult to use. The maps showing locations of the facilities and wells are not at the same scale as the maps showing the results of the various computer runs. The addition of some reference points consistently used throughout the figures would aid in orientation and interpretation of the results.

RESPONSE 1:

Comment noted.

COMMENT 2 (ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY)

Page 44, Paragraph 2

The MFU and LCU probably do not significantly impact groundwater flow and can be ignored in the water budget, however, the MFU is probably not a hydraulic barrier to flow between units.

RESPONSE 2:

Due to the fact that the MFU within the study area is primarily fine-grained, the vertical hydraulic conductivity within that unit is probably very low, thereby, providing somewhat of a hydraulic barrier to groundwater flow in to the MFU and LCU.

COMMENT 3 (ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY)

Page 87, Last Two Points

Detectable concentrations of TCE have been reported for wells which produce from the MFU

RESPONSE 3:

For the purposes of the contaminant transport modeling the simplifying assumption that the MFU is not significantly contaminated was necessary.

COMMENT 4 (ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY)

Page 90, Last Paragraph

The last point is missing the verb "is" before the word "based".

Table 9 indicates that model input values for field parameters were varied over a broader range during the sensitivity analysis than indicated here.

RESPONSE 4:

Comment noted.

Model input parameters were varied from one-tenth to 1370 times the model input value rather than from one-half to 1370 times model input values as reported in the text. The values changed are as reported in Table 9.

COMMENT 5 (ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY)

Page 97-99

Throughout this report, Unidynamics is discussed along with the airport and GAC as a potential source of groundwater contamination at the PGA site. The contaminant transport modeling does not address the plume beneath the Unidynamics facility. An explanation as to why the model does not include the Unidynamics plume may be appropriate here.

RESPONSE 5:

There are several reasons that the contaminant transport model does not address the plume beneath the Unidynamics site. They are as follows:

1. The total extent of contamination in this area was not known at the time the model was discretized. The framework for the contaminant transport model was discussed in a memorandum to the PGA Modeling Sub-Committee dated July 16, 1987.

2. Unidynamics is responsible for the entire RI/FS for their site. The ADWR modeling study supports the EPA, who is the technical lead responsible for the FS for sub-unit C of the UAU beneath the Airport site.

3. Boundary conditions at the NE of the model domain were set too close to accurately simulate the entire extent of the plume in this area.

Although the plume beneath the Unidynamics site was not modeled, the data that ADWR developed as a result of the modeling process was given to Dames and Moore (groundwater consultants for Unidynamics) to assist them

in development of their own model. All of the data collected by ADWR benefited all parties involved at the PGA Site.

COMMENT 6 (ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY)

Page 101, Table 11

Predicted TCE concentrations remaining adjacent to COG #11 well after 21 years under Base Case 3 are higher for Alternatives 4, 5, and 6 than for the No-Action Alternative (Alternative 1). How can this be? This does not seem to agree with the figures of the model-predicted TCE concentrations for these alternatives. In the figures, the model results are presented separately for Subunit A and Subunit B/C. Are the TCE concentrations in this table the sum of concentrations from these Subunits?

RESPONSE 6:

The predicted concentrations for the City of Goodyear Well No. 11 for Base Case 3 range from 1.1 ppb (No Action Alternative) to 5.8 ppb for (Alternative 5). The relatively small rise in contaminant concentration in Well No. 11 could be due to several variables including the proposed FS wells, downgradient of the City's wells. These additional wells could be pulling contamination further towards Well No. 11.

TCE concentrations reported in Table 11 are taken from layers representative of the screened interval of the well.

COMMENT 7 (ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY)

Page 106, Paragraph 2

Do the proposed COG wells withdraw groundwater from Subunit A? Due to ambient inorganic water quality, it is anticipated that the wells would produce from Subunit B/C. Therefore, would the wells be expected to dewater Subunit A?

RESPONSE 7:

The proposed City of Goodyear wells are assumed to withdraw water from sub-units B/C. The problem of the model dewatering near the western model domain is a combination of (1) a groundwater flux out of the model domain, (2) City of Goodyear's projected pumpage for 21 years, and (3) the relatively small saturated thickness of the UAU in this area. However, the proposed City of Goodyear wells would create a typical cone of depression as normally seen from other production wells in this area. Therefore some dewatering from these wells would probably occur.

COMMENT 8 (ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY)

Page 174, Paragraph 2

Table 16 indicates the best reduction of contamination results from Alternative 4. Is this statement regarding Alternatives 5 and 6 accurate?

RESPONSE 8:

Comment noted, this statement is incorrect as Alternative 4 achieves the best reduction of contamination than any of the alternatives including 5 and 6.

COMMENT 9 (CH2M-HILL)

General Comment (1)

The ground water flow model calibration did not benefit from the use of all of the data, specifically the numerous water-level times series available for the area.

RESPONSE 9:

The water level data has not changed significantly during the past two years. However, hydrographs will be incorporated in future model studies of this area.

COMMENT 10 (CH2M-HILL)

General Comment (2)

Data on water levels are very sparse in an areal sense for the large modeled area. This results in our not knowing which way the water flows in the required detail over much of the modeled area. If we don't know, the model surely can't. This makes the accuracy of calculated flow vectors and concentration changes with time very suspect.

RESPONSE 10:

To the west of the airport, there is an area of contamination that we felt necessary to include within the model domain. The problem dealing with this contamination remains, regardless of the tool used to evaluate it. The model predicts the groundwater flow direction reasonably well given the current data available in this area of the site.

In an attempt to address the data deficiences that have been recognized at the PGA site, ADWR proposed to collect additional hydrologic data towards the western site boundary by installing additional monitoring wells. This was proposed in the PGA committee meeting of December 18, 1986. This proposal was not acted upon. Until further hydrologic information is gathered, a lack of adequate data will hinder modeling efforts at this site.

COMMENT 11 (CH2M-HILL)

General Comment (3)

The report presents geologic and hydraulic interpretations different from those we made in the RI/FS report. Some of these are large enough to make a significant difference.

RESPONSE 11:

Comment noted; comments regarding geologic and hydraulic interpretations will be addressed under CH_2MHILL's specific comments that follow.

COMMENT 12 (CH2M-HILL)

General Comment (4)

Sensitivity analyses can give us a feel for the potential effects of uncertainty on the predicted flow vectors and concentrations. Unfortunately, the ADWR work didn't analyze the key parameters sufficiently (some not at all) and didn't measure their results in such a way that we could benefit from what work they did do.

RESPONSE 12:

Comment noted; comments regarding the sensitivity analysis will be addressed under CH_2MHILL's specific comments that follow.

COMMENT 13 (CH2M-HILL)

General Comment (5)

The predicted percent removals should not be treated as accurate engineering estimates. Their use of the model for this purpose can not be supported on the basis of the report or from what I remember them presenting to the Committee.

RESPONSE 13:

I agree that the percent removals should not be treated as engineering estimates, however they can be used to compare how effective the various alternatives are relative to one another using different future scenarios. I think it is fairly clear in the text that the percent removals should be used as a guide and not as a definitive answer. This was just one of the uses of the model, and as an investigative tool the model can be supported by the report and by what has been presented to the Committee as documented in the meeting minutes.

COMMENT 14 (CH2M-HILL)

P. 1, Par. 2

The ground water investigations (monitoring well installation, water quality and water-level monitoring, aquifer testing, geophysical logging) were conducted to support the development and evaluation of remedial action alternatives.

RESPONSE 14:

In the context of this report a detailed groundwater investigation meant that geologic and hydrologic data was collected and analyzed from all sources for support of the modeling investigation. This was done for the

EPA in support of the Phoenix-Goodyear Airport Remedial Investigation/Feasibility Study.

COMMENT 15 (CH2M-HILL)

P. 1, Par. 2

Sufficient information is not provided to evaluate the statement that a reasonable match was achieved.

RESPONSE 15:

I disagree, sufficient information is provided in the report to evaluate whether a reasonable match between simulated and observed parameters was achieved.

COMMENT 16 (CH2M-HILL)

P. 1, Par. 2

The sensitivity analysis as reported in this document did not explore the full range of each parameter's potential value and impact on calculated heads, local velocity vectors, and concentrations. Uncertainty was not quantified.

RESPONSE 16:

The sensitivity analysis did explore the the full range of reasonable values for the reported parameters and the impact that changing these parameters had on the calculated heads and local velocity vectors. The uncertainty was qualified.

COMMENT 17 (CH2M-HILL)

P. 1, Par. 2

There is an inconsistency between the statement that order of magnitude changes in horizontal hydraulic conductivity had little or no effect and the statement that parameters such as horizontal hydraulic conductivity significantly affected the flow model results.

RESPONSE 17:

The last sentence of this paragraph should be revised to read: 'Also brought out . . . model results (i.e., horizontal hydraulic conductivity of sub-unit C)' . . . .

COMMENT 18 (CH2M-HILL)

P. 1, Par. 2

The qualitative evaluations of parameter certainty based on field data can not substitute for a more rigorous analysis of model sensitivity.

RESPONSE 18:

A more rigorous sensitivity analysis will be applied to the next phase of numerical modeling at this site.

COMMENT 19 (CH2M-HILL)

P. 2, Par. 2

The implied accuracy of the predicted percentage removals of contamination is not supported by the apparent problems encountered in applying the TARGET model to contamination evaluations at this site.

RESPONSE 19:

Although percent removals of contamination are presented throughout the report, they are intended to provide a comparative analysis of the base cases and respective alternatives. As presented in the general comments, they were never intended to serve as exact estimates of TCE removal given the number of unquantifiable and unknown variables at this site.

COMMENT 20 (CH2M-HILL)

P. 6, Par. 2

The blanket statement "The disposal of waste products at these facilities occurred from the late 1940's until the 1970's" is questionable and probably not something ADWR wants to say in its model study report.

RESPONSE 20:

This statement is supported by the Source Verification/Field Investigation Report by Ecology and Environment, 1986. Specifically Tables 2-1 (Waste Disposal Summary: Litchfield Naval Air Facility), 2-2 (Waste Disposal Summary: Goodyear Aerospace Corporation), and 2-4 (Waste Disposal Summary: Unidynamics/Phoenix, Inc.), list the waste types, quantities, dates, and reported disposal practices. The statement is true with the exception that disposal of solvents at the Unidynamics facility occurred between the late 1960's through the late 1970's.

COMMENT 21 (CH2M-HILL)

P. 6, Par. 2

Data are not available to say that contamination does not affect the Middle Fine-Grained Unit or Lower Conglomerate Units.

RESPONSE 21:

Comment noted. Information to date indicates that the significant contamination has not yet affected the MFU.

COMMENT 22 (CH2M-HILL)

P. 8, Bul. 5

This bullet indicates that the model study was to simulate the future response of contaminants. Based on this, it would seem that the model study would include predicting movement, not comparing percentage removal or clean-up efficiency.

RESPONSE 22:

The bullet is correct as stated; Figures have been provided in the Feasibility Study that show the predicted flow fields that illustrate groundwater movement, and figures of plumes that illustrate the predicted contaminant movement.

COMMENT 23 (CH2M-HILL)

P. 10, Par. 2

The statement that GAC retains liability for contaminated soils and ground water at the site may be stronger than GAC has actually stated. This statement may not be appropriate for ADWR to make in a model study report.

RESPONSE 23:

The intent of the statement was to indicate that the Loral Corporation is not a Responsible Party at this site even though it owns the property and that the Goodyear Aerospace Corporation is one of the Responsible Parties at this site. It was not intended to offend or make a judgement of liability at this site which is clearly outside of the purview of ADWR and this study.

COMMENT 24 (CH2M-HILL)

P. 11, Par. 1

Eberly and Stanley (1978) defined two units - Unit I and Unit II, not the UAU, MFU and LCU. Also, work by the USGS and others indicates that the upper portions of what has been called the MFU and the entire UAU may be Quaternary in age.

RESPONSE 24:

Comment noted.

COMMENT 25 (CH2M-HILL)

P. 11, Par. 2

Laney and Hahn (1986) address only the East Salt River Valley. The parallel work of Brown and Pool (1989) for the West Salt River Valley is too recent to be included in this model study. At any rate, the Laney and Hahn reference should be explained as pertaining to another sub-basin.

RESPONSE 25:

Comment noted.

COMMENT 26 (CH2M-HILL)

P. 11, Par. 2

The origin of the statements regarding the UAU's thickness, character, and transition to the MFU is not explained. For example, refer to illustrative cross-sections, isopachous, or percent-coarse mapping in this or other documents to which the reader can go to verify these statements.

RESPONSE 26:

The point is taken that the reader should have been informed of these illustrations when they were first discussed. This section of the report is intended as an introduction to the UAU. The reader is referred to the rest of the section, which presents geologic cross-sections, isopach, and structure maps.

COMMENT 27 (CH2M-HILL)

P. 11, Par. 2

I believe that this hydraulic conductivity estimate is an ensemble average of estimates derived from the ADWR Drillers Log Program. Since use of this program is relatively unique, it needs to be discussed when first referenced and its accuracy compared to the more standard aquifer testing methods.

RESPONSE 27:

The hydraulic conductivity value of 750 gpd/ft^2 was derived from an analysis of driller's logs using the Driller's Log Program and specific capacity data. This information has been provided to the PGA Modeling Sub-Committee in a memorandum dated March 11, 1987. The Driller's Log Program was developed by ADWR personnel to generate aquifer parameter data for areas that aquifer tests or specific capacity data were not available. This program is used to calculate computer-generated values for specific yield, hydraulic conductivity, and transmissivity. The results obtained when using this program give a relative distribution of the aquifer characteristics. The accuracy of the results are limited by the quality, quantity, and distribution of the driller's logs within the study area. This program has been used in several of the Department's model studies including but not limited to the Salt River Valley Cooperative Study Modeling Effort (Long et. al., 1982), and Groundwater Modeling Study of the Upper Santa Cruz Basin and Avra Valley in Pima, Pinal and Santa Cruz Counties, Southeastern Arizona (Travers and Mock, 1984). This program is a first cut at determining the aquifer parameters in an area. It should not replace information derived from long term aquifer tests. For the PGA site all available driller's logs were used to evaluate the aquifer characteristics as reported in the above mentioned memorandum to the committee. However, during the course of the RI new aquifer parameter information was gathered and is used in

conjunction with that derived by the driller's log program. Please refer to Table 6, page 62 for the values used in the model.

COMMENT 28 (CH2M-HILL)

P. 11, Par. 2

The reference to Bouwer (1978) here and elsewhere in the text incorrectly implies that a recognized authority supports a very narrow potential range of vertical anisotropy for this particular site. The general nature of Bouwer's suggested guidelines should be discussed when first referenced along with how you applied those guidelines for this site.

RESPONSE 28:

Comment noted.

COMMENT 29 (CH2M-HILL)

P. 11, Par. 2

I disagree with the statement that the UAU is the water table aquifer in the PGA area. My interpretation for the vicinity of PGA is that the UAU contains one water table aquifer (Subunit A), at least one confined aquifer (Subunit C) and at least one leaky aquitard (Subunit B). In fact, there is some field evidence which indicates that Subunit A is confined in some areas. In summary, the UAU is geologic unit defined on the basis of stratigraphy which contains a system of aquifers and aquitards.

RESPONSE 29:

Agreed, the UAU is a geologic unit defined on the basis of stratigraphy which contains a system of aquifers. This description holds true for both the East and West Salt River Valleys. The UAU however, does contain the water table aquifer within Sub-unit A.

COMMENT 30 (CH2M-HILL)

P. 12, Par. 2

The statement that Subunit A thickens at the basin margin should be tempered by the recognition that the general driller's descriptions may not allow precise distinction between the coarse materials of the UAU and LCU which may be in contact at the basin margin. Also the presence of the Gila River indicates that substantial reworking of LCU, MFU and UAU sediments would blur the distinctions in this area adjacent to the Sierra Estrella.

RESPONSE 30:

Comment noted.

COMMENT 31 (CH2M-HILL)

P. 12, Par. 2

If the horizontal and vertical hydraulic conductivities are not equal then the statement should not be made that the average hydraulic conductivity is isotropic.

RESPONSE 31:

It is stated that the average horizontal hydraulic conductivity is assumed to be isotropic throughout the study area.

COMMENT 32 (CH2M-HILL)

P. 12, Par. 2

The use of the Drillers Log Program for estimating horizontal hydraulic conductivity should be thoroughly explained and compared to aquifer testing results.

RESPONSE 32:

Please refer to Response 27 above for an explanation of the Driller's Log Program.

COMMENT 33 (CH2M-HILL)

P. 12, Par. 2

The use of Bouwer (1978) as referenced here is again questioned for supporting such a narrow potential range in anisotropy.

RESPONSE 33:

Comment noted.

COMMENT 34 (CH2M-HILL)

P. 12, Par. 2

A reference or method for estimating specific yield should be provided.

RESPONSE 34:

Specific yield values were derived using the Driller's Log Program and from results of the aquifer testing completed on the site during the RI. Please refer to the memorandum and attached maps sent to the PGA Modeling Sub-Committee dated March 11, 1987 for further information. Also, refer to Response 27 for further information regarding the Driller's Log Program.

COMMENT 35 (CH2M-HILL)

Figs. 3a-3c

The local cross-sections developed by CH2M-HILL in the Phase II Well Installation Memo and the regional cross-sections developed by CH2M-HILL in the RI Report were available to ADWR prior to the release of this report. The subunit contact interpretations made by ADWR are different from those shown in the RI/FS report. What alternate interpretations did ADWR make that led to the development of additional cross-sections?

RESPONSE 35:

Many cross-sections were developed by ADWR during the RI (please refer to the work products that were delivered to the Modeling Sub-Committee in November 1984, and March 1985). The cross-sections included in the modeling report are a combination of drillers logs (data from the previous ADWR cross-sections) and geophysical logs from wells installed as part of the RI. There can be many interpretations of the stratigraphy in this area that are valid, which is why the logs are included in Figures 3a through 3c. The cross-sections that CH2MHILL derived were based on a simple percent fine and percent coarse material. ADWR based their interpretations on descriptive drillers logs and the geophysical information gathered during the RI. The information gathered by ADWR has always been available to the committee, especially the drillers logs for this area. The cross-section information, also has been available to the committee for inspection.

COMMENT 36 (CH2M-HILL)

Figs. 4a-4g

These maps are quite different from figures found in Chapter 3 of the RI/FS Report which present the same titles. ADWR has interpreted different elevations for the contacts between subunits and thicknesses of units than CH2M-HILL has. Since the figures from the RI report were available to ADWR prior to the writing of their report, what alternate interpretations did ADWR make that led to the development of different structural contact and isopachous maps?

RESPONSE 36:

Alternative interpretations are fairly clear throughout the report (refer to Figs. 2 through 4, and Table 2 for the interpreted picks from the available information). Each interpretation of the stratigraphy in this report is adequate and serves the purpose for which it was developed.

COMMENT 37 (CH2M-HILL)

P. 25, Par. 1

The use of the Drillers Log Program for estimating horizontal hydraulic conductivity and Freeze and Cherry (1979) for estimating vertical hydraulic conductivity should be better explained and evaluated. How uncertain are these methods and how do they compare to aquifer testing results?

RESPONSE 37:

Please refer to response 27 above for an explanation of the Driller's Log Program.

In the absence of field data, the values of vertical hydraulic conductivity for the various aquifers and aquitards within the study were derived from a literature review or were assumed as stated in the report.

COMMENT 38 (CH2M-HILL)

P. 25, Par. 2

What methods were used to estimate specific yield and storage coefficient and what accuracy bounds are appropriate?

RESPONSE 38:

Please refer to Response 34.

COMMENT 39 (CH2M-HILL)

P. 25, Par. 2

The discussions of Subunit C aquifer parameter estimates are questioned as they were for Subunits A and B above. In addition, is the potential range in value given for horizontal hydraulic conductivity based on the available data or is it some other type of estimate?

RESPONSE 39:

Please refer to Response 27; aquifer parameter estimates are based on the available data as stated in the text and on Table 6, page 62.

COMMENT 40 (CH2M-HILL)

P. 25, Par. 2

The interpretations of subunit contacts and thicknesses described here are different from those presented by CH2M-HILL in the RI/FS report.

RESPONSE 40:

Please refer to Response 35

COMMENT 41 (CH2M-HILL)

P. 26, Par. 2

Cross-sections or other presentations in this or another report should be referenced to allow the reader to verify the interpretations of the MFU's extent and character.

RESPONSE 41:

Comment noted. Please refer to Response 35.

COMMENT 42 (CH2M-HILL)

P. 26, Par. 2

Are Montgomery and Associates estimates for horizontal hydraulic conductivity locally derived? Would you expect them to represent the MFU as a whole or would the hydraulic conductivity of aquifers in the stringers mentioned be different?

RESPONSE 42:

The reference of horizontal hydraulic conductivity is locally derived, as noted in the referenced document. The value as reported in the Montgomery and Associates report provides an idea of the aquifer properties of the MFU near the study area. I would expect the hydraulic conductivity estimates to vary through out the MFU.

COMMENT 43 (CH2M-HILL)

P. 26, Par. 2

The referenced value of vertical hydraulic conductivity from one test of a 6 foot section of a stratigraphic unit in another sub-basin should be viewed with caution. What data do you have for the MFU in the PGA area that leads you to believe that the estimates from the 6 foot interval in Scottsdale is also representative here? The potential range in value for this parameter in any one location at PGA or Scottsdale is several orders of magnitude, not a factor of 2 as implied here.

RESPONSE 43:

The reported value for vertical hydraulic conductivity was presented as an estimate based actual field data from tests conducted in the East Valley. The text is correct as stated in that the vertical conductivities are not known with certainty and that the data reported is from the East Valley.

COMMENT 44 (CH2M-HILL)

P. 27, Par. 1

References to presentations of data in this or other reports are needed to allow the reader to verify these statements on the extent and character of the LCU. Also, the entire sequence of alluvial fill (UAU, MFU, and LCU) may be 10,000 feet in the basin center, but I doubt that the LCU itself is that thick. I suggest you provide an authoritative reference for that.

RESPONSE 44:

Please refer to Response 35. For further information the reader is referred to the Central Arizona Project Geology and Groundwater Resources Report Maricopa and Pinal Counties, Arizona, published in 1976 by the U.S. Department of the Interior Bureau of Reclamation Lower Colorado River Region.

COMMENT 45 (CH2M-HILL)

P. 27, Par. 1

What potential effects could the pumping in the LCU have on the MFU and UAU? Based on this you could explain why it is reasonable to disregard it in your analyses.

RESPONSE 45:

Within the study area the majority of wells are perforated and with draw water from the UAU. There are relatively few wells that withdraw water from the MFU and fewer yet that withdraw water from the LCU. Since the MFU is at least as thick as the UAU throughout most of the study area and acts as a confining unit, the UAU would be buffered from much of the MFU and LCU pumpage. Therefore it is reasonable to disregard the pumpage from these lower layers.

COMMENT 46 (CH2M-HILL)

P. 27, Par. 2

The reference to Laney and Hahn (1986) should be explained as their report is for another sub-basin. The existence and character of a unit that correlates with the Red Unit of Laney and Hahn in the PGA area is presently unknown.

RESPONSE 46:

Comment noted. It should be stated that this reference is for a similar sub-basin in the Salt River Valley.

COMMENT 47 (CH2M-HILL)

P. 28, Par. 1

I disagree that the three stratigraphic units can be characterized as three distinct aquifers. It is my interpretation that each of the units described in the PGA area contains systems of multiple aquifers and aquitards. I suggest you should revise the wording in this section which describes the UAU, MFU or LCU as "aquifers". The USBR which developed the UAU-MFU-LCU nomenclature used gross stratigraphy to define them. Therefore, they are stratigraphic units, not hydrographic units.

RESPONSE 47:

Although it is true that each of the stratigraphic units in the study area can contain systems of multiple aquifers and aquitards, for the sake of discussion and simplification of interpretation these aquifers and aquitards are discussed based on the three main stratigraphic units (UAU, MFU, and LCU) found within the study area.

COMMENT 48 (CH2M-HILLMOCK)

P. 28, Par. 3

Aquifers in Subunits B and C are under confined conditions as their upper boundaries are below the head measurements made in them. This is based on the definitions for confined aquifers given in Freeze and Cherry (1979). Bear's (1979) definition would classify them as leaky confined aquifers.

RESPONSE 48:

Comment noted.

COMMENT 49 (CH2M-HILL)

Figs. 5a-6b

The point values are very hard to read on these figures.

RESPONSE 49:

Comment noted.

COMMENT 50 (CH2M-HILL)

P. 33, Par. 1

Heads in subunit B are commonly higher than in subunit C. The presentation of figures 7a, 7b, and 7c together is misleading because only figure 7b includes a well perforated only in subunit B. It is important to note that well GMW-2 in figure 7a and well UMW-5 in figure 7c are perforated in the top half of subunit C, not in subunit B. Hydrographs from other well clusters with subunit B wells provide a better demonstration of the head differences between subunits B and C.

RESPONSE 50:

Comment noted.

COMMENT 51 (CH2M-HILL)

P. 33 Par. 2

Hydrographs from different key locations in the area are needed to support the discussion of UAU history. I disagree that the UAU was "largely dewatered". I could accept the observation that subunit C was depressurized 40 to 50 feet

between 1945 and 1965. Even with a 40 to 50 foot drop in subunit C water-levels, the difference in storage coefficients between subunits C and A would likely result in a drop in the water table of less than ten feet which certainly isn't largely dewatered. This water-level fall and subsequent rise would have important consequences for contaminant movement. Such a discussion would be appropriate here in the report.

RESPONSE 51:

The point is well taken that the UAU was probably not largely dewatered. Unfortunately, the lack of high-quality data has prohibited us from knowing exactly how the hydrologic system was behaving historically. The information we do have as presented in figures 8a through 8e gives us snap shots of the hydrologic system during specific time periods from which inferences are made.

COMMENT 52 (CH2M-HILL)

Figs. 8a-8e

What can be inferred from the historical water levels and the presently observed extent of contamination? This could be an aid to understanding the long term ground water flow system and the movement of contaminants.

RESPONSE 52:

There is probably insufficient historic water level and water use information to draw any type of conclusions regarding historical contaminant migration. For this reason the model simulation begins in 1978, when more data are available.

COMMENT 53 (CH2M-HILL)

P. 43 Par. 2

How do water levels in the waterlogged Gila River compare to UAU water levels in the PGA area? Do they indicate if the Gila River gains or loses water in this reach? What quantities of water could be gained or lost?

RESPONSE 53:

During the RI investigation and the preliminary groundwater flow modeling by ADWR at this site many estimates were made of river recharge that range from 0 to 46,500 af/yr as illustrated in Appendix A. Based on current water level data it is very difficult to infer whether the Gila River in this reach is a gaining or losing stream. More information is needed to determine the interconnection between the Gila River and the aquifer in this area.

COMMENT 54 (CH2M-HILL)

P. 44 Par. 1

The data given in this section indicate that the vertical gradients across the MFU maybe 5 to 15 feet per 300 feet of MFU thickness compared to horizontal gradients of 15 feet per 5000 feet. This indicates that vertical gradients are roughly ten times the horizontal gradients in the MFU. Near LCU pumping centers, they could be even higher. The assumption of the MFU being a no-flow boundary should address this observation.

RESPONSE 54:

The vertical gradient in the MFU may be greater than the horizontal gradient however, the vertical conductivity values are much lower, therefore the net flux is less. The MFU was assumed to be a no-flow boundary for modeling purposes, that is simplification purposes.

COMMENT 55 (CH2M-HILL)

P. 45 T. 3

Does BIC concur with the estimated loss of over 6000 af/yr in this stretch of their canal? Also, is there a variation in recharge over time that could account for some of the observed water-level changes over a typical year? How do you resolve the difference between the estimated and calculated changes in storage? Do the indicated ranges in value include uncertainty in all of the parameters used to calculate them?

RESPONSE 55:

The estimate of 6000 af/yr of water lost from the BIC canal was provided by BIC personnel. There definitely could be much variation in recharge over time that could account for some of the observed water-level changes a within typical year. There could be a lot of variation in agricultural recharge for example, however there is very little information from which to base or revise estimates on. The difference between the water budget change in storage and the calculated change in storage is probably within the range of error of all of the data listed in Table 3. The residual is within 25 percent of the overall inflows and outflows which is reasonable given the data limitations for this area.

COMMENT 56 (CH2M-HILL)

Figs. 11b, c

Where are the interpreted aquifer-aquitard or stratigraphic subunits located on this grid? More importantly, is the grid fine enough to include observed gradients of head and concentration?.

RESPONSE 56:

Unfortunately, reponse time did not allow any revisions to the text, otherwise the first comment would have been incorporated. A 200 x 200

foot grid in the horizontal plane and 30 foot in the vertical plane is sufficiently fine to include observed gradients and concentrations.

COMMENT 57 (CH2M-HILL)

P. 56 Par. 1

The use of the assumed dispersivity to calculate the grid sizes may not be adequate. The assumed dispersivity is quite large and recent work at the University of Waterloo indicates that excessively large longitudinal dispersivities are commonly assumed for model studies. Instead, testing of the grid for simplified conditions will indicate if it is of a size and orientation necessary to simulate the observed gradients of head and concentration. No such testing is indicated in the report.

RESPONSE 57:

Usually the dispersivity values are determined as part of the calibration process. This is accomplished by historically reproducing the contamination with the model to arrive at the current plume configuration and concentration. However, this was not possible given the data limitations at this site. This has been clearly stated in the report. The reported dispersivity estimates that were used provided reasonable results as borne out from the transport calculations and there was no justification for reducing these values.

COMMENT 58 (CH2M-HILL)

P. 56 Par. 2

The derivation of the specified flux boundaries is not discussed. Were they varied with time? How were they distributed around the model domain? How does the orientation of the rectangular boundaries with respect to flow affect the distribution of fluxes?

RESPONSE 58:

The flux boundaries used in the transport model were based on previous three-dimensional modeling by ADWR at the PGA site. The results from this previous effort indicated that the flux boundaries did vary with time and that they were distributed proportionally around the model domain. The specified flux boundaries are admittedly not the best condition for a groundwater flow and contaminant transport model. At the time the target model was developed it was thought that rather than expanding the model domain for several miles to include a hard rock boundary, it would be more appropriate to use a flow net analysis to determine the boundary conditions. This information is included in the PGA files in the modeling section at ADWR and is available to interested parties for review.

The orientation of the rectangular boundaries would have little impact on the distribution of fluxes. In other words, even if the grid was oriented north-south east-west the specified fluxes would have been determined and distributed in the same manner.

COMMENT 59 (CH2M-HILL)

P. 56 Par. 4

How well does the present model structure and boundaries match that of the flow net and previous model? What is the uncertainty in the calculated fluxes and their positions?

RESPONSE 59:

The present model structure is almost exactly identical to the three-dimensional groundwater flow model. The main difference between the two groundwater flow models is the use of the USGS MODFLOW code and that of the Dames & Moore TARGET code. These two models handle boundary conditions much differently and it was difficult to transpose the flux values from one model to the other.

There is a large uncertainty in the calculated fluxes and their exact positions along the model boundary. However this uncertainty is mitigated by the fact that the model reproduced water levels that compare with the observed field data.

COMMENT 60 (CH2M-HILL)

P. 58 Par. 1

If these recharge sources are so significant, how large is the uncertainty in these estimates and how does it affect the calculated heads and more importantly, the local velocity vectors?

RESPONSE 60:

It is difficult to quantify the recharge estimates with precision, however a potential range in values has been given in Table 3, page 45 in the text, and Table 2 in Appendix A. Future modeling studies will try to better address the uncertainty in these parameters. The heads will rise or fall commensurate with an increase or decrease in recharge. Recharge is assumed to be negligible at the airport property. Recharge due to agriculture is fairly evenly distributed and would therefore not have a great impact on the local velocity vectors. Much of the uncertainty in these values is mitigated by the fact that the model reproduced water levels that compare with the observed field data.

COMMENT 61 (CH2M-HILL)

P. 58 Par. 2

What is the accuracy of the pumpage data? Are all significant wells included?

RESPONSE 61:

Pumpage data were either reported by the user or estimated by use of power divider records. All significant wells within the contaminant transport model domain were included (please refer to Table 5).

COMMENT 62 (CH2M-HILL)

P. 58 Par. 1-2

The distribution of pumpage and recharge to individual grid cells is not discussed. How does this affect local velocity vectors?

RESPONSE 62:

Pumpage and recharge estimates were distributed within the model domain by overlaying the grid on the area of interest and determining the cell in which the pumpage or recharge occurs. The distribution of these parameters follow the real system as closely as the grid size allows.

COMMENT 63 (CH2M-HILL)

P. 62 T. 6

What methods were used to calculate these parameters? What are their potential ranges in value? What is the need for: specific yield of confined units, TCE specific gravity, TCE viscosity - is this used in the model formulation? If so, how? Wouldn't dispersivity vary with lithology? Given the scale dependent nature of dispersivity, does the given value represent an intermediate for projected growth of the plume or is it an initial value? Finally, how do these values compare to the final model input values?

RESPONSE 63:

The sources of the data are clearly stated in the table. The sources of these data are contained in ADWR files, complete with analyses.

Potential ranges in values were discussed in the text. The model requires all of the input parameters listed except for transverse vertical dispersivity which was erroneously included. Please refer to the TARGET model documentation for a thorough explanation of these values.

Dispersivity does vary with lithology, however it is beyond the scope of the available data to determine how dispersivity varies within the study area. The value of dispersivity appears to give sensible results.

These are the final model input values.

COMMENT 64 (CH2M-HILL)

P. 65 Par. 1

If the water levels are rising, the Gila River would become a gaining stream. This may explain the southwestern flow direction in Subunit A. Since the river surface elevations are known, the model can allow flow into the river when calculated ground water levels are above river levels. This could provide local velocity vectors which are consistent with the real system.

RESPONSE 64:

Comment noted. The model reproduces velocity vectors consistent with the real system and may replicate discharge to the Gila in future years.

COMMENT 65 (CH2M-HILL)

P. 65 Par. 2

Why weren't the results of spinner-flowmeter surveys in eight productions wells at PGA used to guide the vertical distribution of pumpage? Information gathered from this program is considered more representative than estimates based on drillers calls.

RESPONSE 65:

The information provided from the results of the spinner-flowmeter survey does not correlate from well to well and therefore can only be used to distribute pumpage in the well that the testing was done. Future modeling at this site may include the results of the spinner-flowmeter surveys.

COMMENT 66 (CH2M-HILL)

P. 66 Par. 3

This logic would preclude the use of Agua Fria River recharge (Page 48, Table 4).

RESPONSE 66:

Agreed which is why Agua Fria River recharge is not included in the model. The rate given in page 48, Table 4 was done so for completeness and information.

COMMENT 67 (CH2M-HILL)

P. 68 Par. 2

Estimates of field scale dispersivity vary widely. The modeling should account for this. Recent work suggest that large values are probably not representative. What relation does dispersivity have to soil types?

RESPONSE 67:

The estimates for dispersivity values are based on a literature source as stated in the text. Unfortunately there are no measured values for this parameter at this site. Therefore, it was necessary and appropriate to make this assumption. In addition, since calibrating the model to an area and concentration of contaminant was not possible due to the lack of historical source information, this assumption was the most appropriate to make. It would not help to make up a variability in the dispersivity estimates as suggested due to the uncertainty involved in the parameter itself. The reference for dispersivity values is for alluvial sediments.

COMMENT 68 (CH2M-HILL)

P. 69 Par. 3

The observed variations in concentration with depth could be used to guide the distribution used in the model. It is possible that the assumption of full vertical mixing of observed values is not conservative. The potential uncertainty in the field data should be discussed because it relates strongly to the usefulness of the model's output.

RESPONSE 68:

The observed variations in concentration with depth were used to guide the distribution of the contamination in the model. I think the approach taken was conservative based on the available data.

COMMENT 69 (CH2M-HILL)

P. 71 Par. 2

Because the simulation is transient and the areal distribution of head data is sparse, comparison of model-simulated to the abundant measured hydrographs in the area should have been the key criteria for flow model calibration.

RESPONSE 69:

Comment noted. Future modeling by ADWR at this site will include calibrating to some type time-series analysis. However, it should be noted that the abundant measured hydrographs are for very specific areas near the RP facilities.

COMMENT 70 (CH2M-HILL)

P. 71 Par. 4

Were fine enough time steps used to benefit from the six-month breakdown in pumpage?

RESPONSE 70:

Initial tests of time step sensitivity indicated that the time steps used were fine enough to benefit from the six-month breakdown in pumpage.

COMMENT 71 (CH2M-HILL)

P. 73 Par. 1

Although the simulated gradients are said to be close to measured gradients, inspection of figure 14a indicates that interpolation between data points yields gradients near the Airport which are more than twice those simulated. Large areas are present for which the local velocity vectors can not be determined by visual inspection. Are the stated velocities for the center of mass or the edge of the contamination? There is no clear demonstration that the model matches historical data.

RESPONSE 71:

The stated velocities are representative of the flux in the areas of contamination and are as noted in Table 8 on page 84. The model matches the observed data as presented on Figures 14a through 15e and as stated in the text. It is important to note that this model is the best tool available to analyze the groundwater flow system in this area. Though there are many data deficiencies within the study area these have been recognized by the EPA, ADWR, and CH2MHILL since 1985. ADWR has suggested that additional information be gathered in areas other than the RP's however this has not been acted on. Therefore until more information is collected the model is the best tool available.

COMMENT 72 (CH2M-HILL)

P. 84 Par. 1

The comparison of heads does not indicate if the local velocity vectors are correct. What may seem like a close head match could result in local flow directions which are 90 degrees or more in the wrong direction. This point is critical to evaluation of the model estimates. The discussion in this paragraph of the paucity of data for determining the goodness of fit only indicates that we do not have enough information to determine if our model is simulating the real system.

RESPONSE 72:

The equipotential lines as illustrated on figures 14a through 15e indicate that the predicted flow directions near the RP facilities and further due west of the facilities are consistent with historic and present flow directions. There is no indication that the flow directions are 90 degrees or more in direction opposite of what the simulated heads represent. In simulating the RA's the model did a good job in predicting local velocity vectors, (please refer to the figures in the Groundwater Modeling Feasibility Study section of this report). It is true that there is not enough information to the west of the RPs to determine if the model simulates the real system.

COMMENT 73 (CH2M-HILL)

P. 85

See previous comment.

RESPONSE 73:

Please refer to Response 72.

COMMENT 74 (CH2M-HILL - PETER MOCK)

P. 86 Par. 2

Inspection of figures 14a through 14e indicates that the ground water model flow calibration to the available head data is incomplete. Data are not

available within enough of the modeled area to indicate what gradients and local velocity vectors are present in the real system. Addition calibration to the abundant measured head hydrographs in the area could be used to improve the confidence in the ground water flow model calibration. We do not believe that confidence can be placed in the model's prediction of gradients and local ground water velocities.

RESPONSE 74:

Comment noted. Most of the abundant measured hydrographs referred to are represented in Figures 14a through 15e. This data is localized in the area of the RPs. Within the rest of the model domain, there is very little information available to indicate what gradients and local velocity vectors are present in the real system.

ADWR recommended in 1986 that additional monitor wells be installed to gather more regional data within the study area. Additional data collection is necessary to achieve the local accuracy referred to above. However, since this was not done we have to live with a degree of confidence based on the available data. The model is a useful comparative tool, but is based on limited available data.

COMMENT 75 (CH2M-HILL)

Figs. 16a, b

What is the uncertainty in these distributions?

RESPONSE 75:

There is much uncertainty in these distributions, however, this is the best information we have. The text on page 97, paragraph 1 lists the source of information for both the sub-unit A and B/C plumes.

COMMENT 76 (CH2M-HILL)

Table 9

The sensitivity analysis is incomplete because it does not run the model with the full potential range in each parameters value. For example, hydraulic conductivity could easily vary over several orders of magnitude. The rationale for the selected variations used for analysis is not clear. Given that the use of this model would be for contaminant transport, the variations in the velocity field caused by uncertain parameters are of most critical concern. It is not clear why the effect of variations was only observed on calculated heads (especially porosity which probably is not included in head calculations). The percentage change in head during the simulation period per percentage change in the selected parameter provides a much stronger indication of sensitivity. The sensitivity analysis time period should be as long as the expected projection time period for its results to be useful. An expanded sensitivity analysis which includes variations in all uncertain inputs including recharge and boundary conditions would be required to fully evaluate this model's usefulness for projections.

RESPONSE 76:

Comment noted. This will be taken into consideration in future modeling at this site.

COMMENT 77 (CH2M-HILL)

P. 96 Par. 1

The parameters critical to transport were not analyzed. If a parameter such as dispersivity or porosity, is not measured or if it is poorly known, then it is even more critical that its potential effect on model results be evaluated. Sensitivity analysis is far from an academic exercise if its importance is understood.

RESPONSE 77:

Please refer to Responses 67 and 74.

COMMENT 78 (CH2M-HILL)

P. 172

An evaluation of the model's projections was curtailed because of the large uncertainties discovered in the ground water flow modeling and transport sensitivity analysis. The accuracy of the model's calculated velocity field and resulting contaminant concentration can not be even roughly guessed at with the available information. The predicted reductions in concentration must therefore be viewed as one set of potential outcomes whose accuracy is unknown. A cursory examination of the projection runs indicates excessive drawdowns near model boundaries and extensive movement of contamination that has not occurred to date. These observations call into question the ability of the model to simulate the ground water flow system at PGA.

RESPONSE 78:

Comment noted. Please refer to Response 74.

COMMENT 79 (CH2M-HILL)

P. 172 Par. 2

We disagree with the statement that the results of the sensitivity analysis indicate that acceptable confidence can be put into the ground water flow model calibration results.

RESPONSE 79:

Comment noted. Please refer to Response 74.

COMMENT 80 (CH2M-HILL)

P. 174 Par. 3

While the model does provide a relative evaluation of the various ground water remediation alternatives, the accuracy of that evaluation can not be estimated with the information provided. Considerable sensitivity analyses on the model with respect to uncertain transport parameters, numerical stability and the model grid orientation and size would be required to develop some understanding of the model's performance and accuracy.

RESPONSE 80:

Comment noted. Please refer to Response 74.

rb

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12 September 1989

Mr. Jeff Rosenbloom, Chief
Enforcement Programs Section
United States Environmental Protection Agency
Region IX
215 Fremont Street

Dear Jeff:

Enclosed is the response to comments you requested which were prepared by our consultant, Dames & Moore.

Please call me if you have any questions.

Very truly yours,

W. C. Donahue
Director
Human Resources

WCD/dl

Enclosure

Responses to Corps of Engineers
Page 1

COMMENTS BY TED STRECKFUSS, ENVIRONMENTAL ENGINEER

Page 5-8 Include documentation substantiating the selection of a 100 ppb level for a removal concentration in Subunit A.

Response: See our responses to ADEQ RI Comment #3 dated July 7, 1989, EPA FS Comment #30 dated June 9, 1989 and Technical Comments dated July 17, 1989.

Page 5-9 Document the selection of the 10,000 cfm gas flowrate to be used in the air stripper. This flow rate appears to be excessive.

Response: See our response to CH2M Hill Comment #24 dated March 23, 1989.

COMMENTS BY JOHN E. SARTORE

General Comments: The preferred remedial alternatives proposed for site remediation (Alternatives A-1 and A-2) are not supported by the analytical data presented in this draft. Additional assays are needed especially at Waste Facility #1 and building 19 areas. Conclusions reached throughout the draft are often based on speculation.

Response: The comment does not provide support for its conclusion and is not specific enough about the areas of disagreement to allow for specific rebuttal.

Page 2-11, 2.3.2.6 Building 19, Paragraph 2.

1. The groundwater beneath Building 19 contains more than 100,000 ppb. of Trichloroethene (TCE). Considering the Density of TCE and the solubility of TCE in water, there is probably a layer of TCE present in the lower part of the Aquifer (Subunit A).

Response: Comment noted, conclusion reached is not substantiated.

2. There is insufficient data to support the statement that "Building 10 does not appear to be a source of VOC's to groundwater based on the data collected.

Response: See our response to EPA RI comment #8 dated June 9, 1989.

Page 2-11, 2.3.2.7 Drum Storage Area

The open area to the north of Building 19 used to store empty solvent drums is now bare which indicates that solvents could be present in sufficient quantities to suppress the growth of grass in that area.

Response: The entire UPI facility is controlled to be purposely grass-free with the exception of the front lawn near the reception area. The no-grass areas are intentional and have been since 1963.

Page 2-16, Sentence #4

The conclusion that Waste Facility #1 is the primary source contributor of TCE to groundwater is not supported by this analytical data presented.

Response: See our response to ADEQ RI comment #2 dated July 7, 1989.

Page 2-13, Paragraph 3

The analytical results on soil sampling indicate that the high Barium and Aluminum concentrations found need to be further investigated. Although Aluminum was not reported as being used at the facility, the pond assay results (80,000 mg/kg) cannot be ignored.

Response: Comment noted.

Page 2-16, Sentence #4

The conclusion that the Waste Facility #1 is the primary source contributor of TCE to groundwater is not supported by the analytical data presented.

Response: See our response to comment regarding 2-16, Sentence #4.

COMMENTS BY DAVE BECKER

RI, Page 2-10

Low levels at various facilities do not necessarily suggest that the facilities are not sources - look at low levels at some areas at the GAC/Airport areas.

Response: See our response to EPA RI comments #7 and #8 dated June 9, 1989.

RI, Table 2.1

Were any analyses done for explosives and volatile propellant at building 12?

Response: Building 12 is designated as Waste Facility #8. Table 2.3 and 2.4 of the RI reports that this facility was tested for total metals within the sedimentation tank and for VOC concentration and total metals within the soil surrounding the sedimentation tank. No other testing was performed.

RI, Page 3-18, last paragraph

MW-14 is not really directly downgradient - more crossgradient - this may impact the definition of contamination in "C".

Response: See our response to CH2M Hill comment #8 dated March 23, 1989.

RI, Page 3-19, top paragraph

Can well SF4A be a cross-contamination source? Should it be replaced with a well not open to "A"?

Response: See our response to ADEQ RI comment #38 dated July 7, 1989

RI, Page 3-20, 3rd to last line

Describing "B" as a barrier is too strong - it's a leaky barrier.

Response: See our response to EPA RI comment #13 dated June 9, 1989.

FS, Page 1-2, see 1.2.1

The RI did not characterize ground water over 6 sq. miles.

Response: The text states that the Unidynamics study area is approximately six square miles. Separately, the text states that the RI characterized groundwater and soil quality. To interpret and combine these two sentences in the manner which this comment does is incorrect.

FS, Page 2-14, 3rd paragraph

Dilution will reduce VOC levels but increase volumes over ARARs - may be foolish to wait!

Response: See our legal comments dated August 1, 1989.

FS, Page 2-15, 2nd paragraph

Remember 2 possible sources of TCE - TCE in vadose zone and DNAPL in saturated zone - Nothing is said about addressing possible pure TCE at "A"/"B" interface. Either way, dilution would take a very long time considering levels at UPI.

Response: Dilution and point-of-use treatment options address the possibility that pure TCE may be present at the Subunit A/Subunit B interface.

FS, Page 2-16, 1st full paragraph

Reference in 4th line of paragraph to current point of use is misleading - the point is that you don't know where "points of use" will be in future.

Response: Comment noted.

FS, Page 2-20, 3rd paragraph

Though no estimates of risk were made - level of risk will undoubtedly increase.

Response: The comment does not provide support for the conclusion that the level of risk will undoubtedly increase.

FS, Page 2-20, see 2.7.3.3

This section downplays risk too much.

Response: The purpose of this section is to report the potential risks arising from exposure to on-site groundwater. This is done in an objective manner using quantitative results. It cannot be intimated from any part of this section that the risks are "downplayed".

FS, Page 3-7, 1st full paragraph

I disagree that "A" is a III aquifer - try IIb.

Response:
- o See our legal comments dated August 1, 1989.
- o See "Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy", December, 1986.

FS, Page 3-9, last line

Exposure pathways does not lead to risk levels greater than 10^{-4} now - but may if points of exposure change in future.

Response: Comment noted.

FS, Page 3-10, see 3.3.1.5

Exposure to soil is not the impact of concern - TCE in the soil can continue to impact groundwater.

Response: The primary concern associated with TCE contamination within the soil is indeed its potential impact on groundwater. However, since the possibility that exposure to TCE in the soil could occur, a complete investigation of this possibility and its ramifications was performed.

FS, Page 3-13, last sentence

Disagree that the technological and permitting makes aquifer recharge less desirable.

Response: Comment noted.

FS, Page 3-18, 2nd paragraph

Disagree with conclusions here.

Response: See our legal comments dated August 1, 1989.

FS, Page 4-3

1st bullet - ... process in handling...What?

Response: This statement is referring to the ability of the process to reduce toxicity, mobility or volume of the contaminants.

FS, page 4-6

last bullet - SVE should be option without capping.

Response: The comment provides no support for its conclusion and cannot be addressed.

FS, Page 5-6, last paragraph

Time for treatment will be very long especially if pure product is present.

Response: Comment noted.

FS, Page 5-8

Treatment to 100 ppb TCE is probably not acceptable - how was 100 ppb chosen? I wouldn't think that assuming dilution with B and C is acceptable way to meet ARAR.

Response: See our responses to EPA FS comment #30 dated June 9, 1989; ADEQ RI comment #3 dated July 7, 1989, and legal comments dated August 1, 1989.

FS, Page 5-9, 2nd to last paragraph

Will the State let you pump wells for waste? That's what you'd be doing in going to sewer.

Response: There are serious and unanswered questions regarding the implementability of this option. These are discussed in Chapter 5, pages 5-21 to 5-22 of the FS.

FS, Page 5-19, 1st full paragraph

GW-1 should be GW-3 (Also on page 5-21).

Response: A typographical error occurred in the preparation of the text. GW-1 should be GW-3 as pointed out.

FS, Page 5-21

Mention need to limit and discharge of VOCs to 40 lb/day as part of implementability.

Response: We recognize that air emission limitations may be needed.

FS, Page 6-9, last sentence of top paragraph

The logic here (not treating all water, only water used) is poor when dealing with the levels you have in Subunit A.

Response:
- o The comment does not provide support for its conclusion.
- o See our technical comments to EPA dated July 17, 1989.

FS, Page 7-3, 2nd paragraph

Uncertainties in contaminant fate could be reduced if you dealt with the problem now.

Response: Comment noted.

FS, Page 7-4

I disagree with technical logic behind recommended alternatives.

Response: This comment is not specific enough about the areas of disagreement to allow for a response.

Response to G. Stephenson Comments
from City of Goodyear on RI/FS
Page 1

VOLUME 8, CHAPTER 1 - RI COMMENTS

Page 2-3 Paragraph four. The conclusion presented regarding waste facility 4 is not supported by the evidence given. "Ifs" and "probablys" are insufficient to establish a firm conclusion.

Response: See our response to EPA Comments dated June 9, 1989.

Page 2-11 Last paragraph, second sentence. "Some liquids" .... Should describe them or identify if possible.

Response: The identity of the liquids is not known.

Page 2-16 Last four bullets require more evidence than presented in this chapter in order to make these conclusions.

Response:
- o Third bullet: See our response to ADEQ comments dated July 7, 1989
- o Fourth bullet: See our response to EPA comments dated June 9, 1989
- o Fifth bullet: Comment noted
- o Sixth bullet: See our response to ADEQ comments dated July 7, 1989

Chapter 3
Page 3-9 First paragraph. Be more specific in gram size rather than use of terms like "fine grained", etc. It is important here because of the controversy regarding possible groundwater movement between subunits. The gram size data is surely available from sieving of the drill samples.

Response:
- o Drill samples were not sieved as per EPA - approved drilling program.
- o A more thorough and detailed description of the UAU subunits and MFU characteristics, including composition can be found in Chapter 3, Vol. I (Public Comments Draft) of the RI/FS.

Page 3-19 Second paragraph. Mixing units - be consistent. Use either ug/l or ppb, not both.

Response: Comment noted.

Page 3-19 Third paragraph, last sentence. Data from the City of Goodyear files for the years 1983-1988 would be better than Black & Veatch, 1985. Average groundwater production for the city of 1983-1988 was 920 af/yr (City of Goodyear Water Use Reports, 1989).

Response to G. Stephenson Comments
from City of Goodyear on RI/FS
Page 2

Response: Comment noted.

Page 3-19 Last paragraph. The City currently uses a total of 8 wells, not 6. Need to be more thorough about the location of Well #10. The so-called "warehouse" currently employees 237 people and is expanding. They expect to employ 80 more over the next two years. Well #10 is a sole source, sole supply for this facility. City Well Nos. 2 and 3 are both screened in Subunit C, and both have recorded TCE concentrations as high as 6.8 ug/l and 16.0 ug/l respectively. This should be recognized here.

Response:
- o The text states that the City currently has a total of 8 wells that supply the water distribution system.
- o Comment noted regarding the warehouse.
- o The text recognizes that City Well Nos. 2 and 3 have detectable TCE concentrations.
- o See our response to the comment regarding pages 2-4, fourth bullet, last sentence.

Page 3-20 First paragraph. Well No. 10 is perforated in the upper part of the Middle Fine Grained Unit (381'-578') as determined by a TV scan by Gilbert Pump Company in August, 1984 (City of Goodyear files).

Response: This information is already included in the text.

FS COMMENTS - CHAPTER 2

Page 2-2 Paragraph two. The site encompasses 35 square miles, not 25. Litchfield Park is not in the site boundary. Except for the Loral facility, and the Phoenix-Goodyear airport, and about 4 square miles of Avondale along the southeast part, the remainder of the site lies within the City of Goodyear.

Response: Comment noted.

Page 2-3 Paragraph two. Is Subunit B also a "water-bearing zone"? See page 2-11, third paragraph, where it is referred to as such.

Response: Although it is not explicitly stated at this point in the text, Subunit B is a water-bearing zone.

Page 2-4 First bullet, "hydraulic isolation" seems to be inappropriate usage here. Simply because of a local change in gradient does not mean that regionally the areas are not part of the same system.

Response: The text does not imply that the two subareas are not part of the same regional system. However, the text does point out that a divide within this system has caused groundwater to flow in two distinct directions leading to a hydraulic isolation of the groundwater contamination within the two subareas.

Third bullet, last sentence. Not sure what this means, but it can be interpreted as saying the evidence is disputable. Would two negatives make it positive?

Response: While previous investigations have yielded insights into the degree of interconnection between Subunits B and C, the exact extent of this interconnection has not been established. Hence, the statement "no indisputable" evidence refers to the uncertainty regarding the evidence.

Fourth bullet, last sentence. This statement is wrong! City Well No. 2 recorded 8 ug/l TCE on 4/14/87 and No. 3 recorded 16 ug/l TCE on 10/9/87. Both are well within the vicinity of UPI.

Response:

- According to Chapter 3, Table 3.4, Vol. I (Public Comments Draft) of the RI/FS, the highest detected concentration recorded in City Well Nos. 2 and 3 is 6.8 ug/l.

- The implication of this comment seems to be that since COG Well Nos. 2 and 3 lie within the general vicinity of UPI, the facility is responsible for causing the elevated TCE concentrations. However, generally known features of this facility do not support this conclusion. First, regular water measurements have not shown groundwater flow towards City Wells #2 and #3. Furthermore, these wells are located cross-gradient to and outside of the known TCE contaminant plume and would not be affected by UPI activity.

Page 2-6 Paragraph three. Use of the words "most solvents" implies that there are solvents not stored. How about those that are not? What is done with them? Use of "most" and "some" leaves the impression that 49% could be elsewhere. Need to be more exact in your statement. The data support it.

Response to G. Stephenson Comments
from City of Goodyear on RI/FS
Page 4

Response: Solvents not stored are those solvents not regulated by EPA or ADEQ. These are solvents which are not listed under RCRA.

Page 2-8 Second paragraph. Unclear as to what the background concentrations were.

Response: Background concentrations for aluminum, barium, arsenic, mercury, lead, chromium and zinc are listed in Chapter 2, Table 2.10 of the RI.

Page 2-12 First paragraph. Absolutely no supporting evidence to say that uncertainty exists regarding connection between Subunits B and C. The fact that TCE is present in Subunit C is evidence enough to verify connection. The method of connection, either hydraulic or via poorly constructed wells or both, may be uncertain.

Response: The text states that there is uncertainty regarding the degree of interconnection between Subunits B and C. It does not state that there is uncertainty regarding connection between Subunits B and C.

Page 2-13 Last paragraph. Use mean concentrations instead of average to be consistent with Table 2-1. Table 2-1 has 179,000 not 180,000.

Response: Comment noted.

Table 2-1 Put note for units at top of Table. Cannot tell from thee Table which units are A and which are C unless the reader knows more detail about the wells. A note stating 5, 6 and 10 are Subunit C wells would help.

Response: The subunit in which a particular well is located can be determined from the heading "Aquifer" which plainly states this information.

Page 2-14 First paragraph. Be consistent when using average and mean.

Response: Comment noted.

Last paragraph and top of page 2-15. If contaminated groundwater in Subunit C has not moved off-site, how do you account for contamination in Subunit C off-site City Wells Nos. 2 and 3?

Response: See response to comment concerning Page 2-4, Fourth bullet.

Page 2-16 Second paragraph, last sentence. The City is not willing to gamble any longer on the fact that their, "supply wells are not likely to be affected, if at all, for several years." Some are already affected.

Response: Proposed remedial action would provide for well-head treatment of city wells, if needed. There would be no "gamble" on city's part.

Response to G. Stephenson Comments
from City of Goodyear on RI/FS
Page 5

Page 2-18 First paragraph. There is too much conjecture in this entire paragraph, which is not supported by evidence. Certainly, conditions may change but projections must continue to be made. The projections for growth have been made based on sound planning. Granted, they are not absolute, but they are predicated on a clean, adequate groundwater supply.

Response: Comment noted.

Page 3-7 First paragraph, last sentence. Remember that S.C. #4A is screened from 140' to 685'; that is from mid Subunit B well into the MFU, and has recorded TCE concentrations as high as 22 ug/l. This would certainly indicate that the MFU <u>is</u> affected adversely by the release of TCE at this site.

Response: No wells have been screened exclusively in the MFU. Therefore, it is not possible to claim with any degree of certainty that the MFU <u>is</u> adversely affected by the release of TCE at this site. The high level is most probably attributable to TCE contamination present in subunit A.

Page 3-17 Second paragraph, under Section 3.4.1. Nothing given to support this. In fact, see above comment.

Response: The comment is not specific enough regarding the area of disagreement with the text.

Page 3-18 First paragraph, last sentence. How is this so when TCE <u>is</u> recorded in Subunit C as you have noted previously.

Response: The comment is not specific enough regarding the area of disagreement with the text.

Page 6-5 First paragraph. The MCL for Subunit C <u>has</u> been exceeded.

Response: See our response to the comment concerning Page 2-4, fourth bullet, last sentence.

Response to ADWR Comments
Page 1

GENERAL CONCERNS

The preferred remedial alternative for the Unidynamics site allows for continued degradation of the drinking water aquifers. The uncertainty whether trichloroethene and other solvents will migrate to the Subunit C aquifer is itself a reason to take a conservative approach and implement remedial actions to prevent contamination from migrating to the Subunit C aquifer, which will include treatment of Subunit A.

Response: Comment noted.

Not enough information is available to discount contamination in the MFU at this time in the Superfund area.

Response: Nor is enough information available to speculate that the MFU is adversely affected.

Volume VII/RI

For each organic compound listed on the page, the minimum and maximum concentrations should be stated along with their frequency of detection.

Response: A listing of minimum and maximum concentrations for each detected organic compound is more meaningful when it is presented with the location at which this minimum/maximum occurs. This information is presented in Chapter 2, Table 2.7 and 2.8 of the RI.

Page 3-2, First Full Paragraph and Table 3.1:

The monitor well completion data for MW-1 through MW-4 is missing from Table 3.1. This information needs to be included.

Response: See our response to ADEQ RI comment #30 dated July 7, 1989.

Page 3-16, Second Paragraph:

The Environmental Quality Act affirms that all aquifers in the state are classified for drinking water purposes.

Response: See our legal comments dated August 1, 1989.

Page 3-20, Second Paragraph; Reference: Map of Well Locations for Abandoned and Destroyed Wells (USGS and ADWR Records; Prepared by CH2M-HILL; Last Update, May 1988):

Several abandoned wells exist within the plume of organic contaminants migrating from the Unidynamics facility. The report fails to recognize that these wells may be acting as a vertical conduit for contaminants to migrate from subunit A to the lower aquifers.

Response: Comment noted.

Page 3-21, Second Paragraph:

The reported hydraulic conductivity values in this paragraph do not agree with the reported values for transmissivities on page 3-13 when using the reported saturated thicknesses as found in section 3.2.1.2 on pages 3-6 through 3-8.

Response: Comment noted.

FS/Page 2-11, Second and Fifth Paragraphs:

The reported hydraulic conductivity values are not consistent with what is reported in the Remedial Investigation Section of this report.

Response: Hydraulic conductivities are reported in the text at three different locations: Chapter 3, page 3-21 of he RI; Chapter 3, Table 3.5 of the RI; Chapter 2, pages 2-10 to 2-11 of the FS. These values (in gpd/ft^2) are summarized below:

	Page 3-21 (RI)	Table 3.5 (RI)	Pages 2-10 to 2-11 (FS)
Subunit A	100-200	50-120	120-220
Subunit B	<50	-	14-100
Subunit C	600-1400	798-1430	280-340

Clearly, the above table shows that Subunit A and Subunit B hydraulic conductivity values are consistently reported. There is a discrepancy between the reported RI values and the FS value for Subunit C. The correct values for Subunit C are those presented in the RI.

Page 2-12, First Paragraph:

Although the interconnection between subunits A and C has not been very well established at the UPI site, the assumption that no contaminants will migrate due to a lack of information is not appropriate. It is apparent that additional information is needed to determine vertical hydraulic conductivities and the extent of the interconnection between subunits A and C.

Response: The text states that the degree of interconnection between the subunits is uncertain. Because of this uncertainty, the rate of migration of the contaminants, and consequently, the long-term impact of TCE contamination on Subunit C, is unknown. The text does not say that this uncertainty is reason to conclude that no migration will occur.

Page 2-12, Second Paragraph:

The direction of groundwater flow in subunit A at the airport is to the west-southwest; it is not strictly to the southwest as stated in the report.

Response: Comment noted.

Page 2-14, Top of the Page:

The concentrations of trichloroethene in MW-5 and MW-6 should be the basis for concern as they are close to the MCL of 5.0 parts per billion.

Response: Comment noted, also see our legal comments dated August 1, 1989 relative to MCL's.

Page 2-14, Second Paragraph:

The assumption that adsorption of TCE and other VOC's onto aquifer material removes them from the groundwater, reduces their concentration, and retards their movement may or may not be appropriate at this site. At the Motorola 52nd Street site tests conducted on similar materials indicated that adsorption was not important in restricting the movement of contaminants.

Response: Comment noted, we do not agree that the two sites are geologically "similar" however.

Page 2-14, Third Paragraph

The assumption that the plume will eventually be diluted and reach some sort of steady state condition may be theoretically true, however this is by no means a practical solution to the problem. It will take a very long time for this to occur and a large volume of clean water. Even if the source of the contamination is removed the area of contamination will become larger as the plume disperses.

Response: See our response to ADEQ FS comment #6 dated July 13, 1989.

Page 3-2, Second Paragraph:

The Environmental Quality Act and the Groundwater Management Act should be recognized in this section.

Response: See our legal comments dated August 1, 1989.

Page 3-5, <u>Waivers from ARARs</u>:

The relevance of the exceptions has not been supported. Those exceptions that are deemed relevant should be stated.

Response: See our legal comments dated August 1, 1989.

Page 3-7, First Paragraph:

Please refer to comment 3.

Response: See our legal comments dated August 1, 1989.

Page 3-9, Top of the Page:

The MCL, ARAR, is five micrograms per liter for TCE in aquifers designated as drinking water aquifers by the State of Arizona. The Environmental Quality Act designates all aquifers in the state as drinking water aquifers.

Response: See our legal comments dated August 1, 1989. Also see "Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy", December, 1986.

Page 3-11, Ground-Water Withdrawal:

The right to withdraw groundwater would need to be obtained from the Arizona Department of Water Resources.

Response: Under CERCLA, substantive compliance is required.

Page 3-11, Ground-Water Withdrawal, Paragraph 1:

ADWR does not have authority to prevent the installation of all wells, nor does it have ultimate authority in limiting the use of water in any area.

Response: ADWR does have authority to regulate well construction standards which could be used to eliminate groundwater use from specific zones.

Page 3-11, Fifth Paragraph:

Withdrawal of groundwater at the Unidynamics facility will require a groundwater withdrawal right. ADWR considers a PQGWP as a right to withdraw water and will require a PQGWP to be obtained.

Response: It is our understanding that substantive compliance for a PQGWWP is all that is required under the provisions of CERCLA.

Page 3-13, Surface Water Discharge:

The Phoenix Active Management Area will not permit this type of end use as it is not consistent with the Groundwater Management Act.

Response: Comment noted.

Page 3-18, Second Paragraph:

The ARAR or TBC conclusions of this paragraph have not been supported nor approved by the agencies.

Response: See our legal comments dated August 1, 1989.

Page 5-12, First Paragraph:

The statement that the "No Action" or monitoring alternative would be sufficient to protect public health is not appropriate due to the uncertainties that exist in the current data regarding the extent of subunit C contamination and vertical permeability estimates. These data deficiencies should be determined before any remedial alternative is chosen.

Response: The text recognizes that there are several factors which will impact the long term effectiveness of this option. Specifically, Chapter 5, Page 5-13, Section 5.3.11 of the FS lists these factors as:

- o The extent of TCE migration into Subunit C
- o Effects of development of additional groundwater supplies and its impact on fate and transport of TCE in the groundwater system
- o Whether future wells will produce water from Subunit C
- o Effects of attenuation in Subunit C

This option incorporates groundwater monitoring to gauge the long term effectiveness of this option. Should drinking water be threatened, the monitoring network will provide early warning and sufficient opportunity to take additional actions to prevent human health from being endangered. In this way, public health is protected.

Page 6-6, Long-Term Effectiveness:

The health risks might be controlled but it is not clear if they would be protective of human health and the environment. It is highly uncertain that the impacts could be controlled.

Response: The comment does not provide support for its conclusion.

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CRANE UNIDYNAMICS/PHOENIX

FILE PGA 2.1

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2 August 1989

Mr. Jeff Rosenbloom, Chief
Enforcement Programs Section
United States Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, California 94105

RE: Response to ADEQ's comments - Unidynamics RI/FS Report

Dear Jeff:

Enclosed per your request are Unidynamics' responses to Arizona Department of Environmental Quality's comments on our RI/FS.

If you have any questions, please contact me at 602/932-8245.

Very truly yours,

W. C. Donahue
Director
Human Resources

WCD/dl

Enclosures

xc: M. Corash
F. Stephenson
G. Seifert
T. Ungerland

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1. EXECUTIVE SUMMARY, GENERAL COMMENTS

The executive summary should include a description of the location and size of the Phoenix-Goodyear Arizona Study Area. The location should be provided in Township, Range, Section and quarter section as well as by street address.

Response: Text will be revised from "The Unidynamics Phoenix, Inc. Facility is located in the northern portion of the Phoenix-Goodyear Airport (PGA) Superfund area" to "The Unidynamics Phoenix, Inc. facility is located in the northern portion of the Phoenix-Goodyear Airport (PGA) Superfund area located in Goodyear, Arizona.

Chapter 2 of the FS provides a detailed site description and which locates the facility relative to the PGA study area. The text will provide the Township, Range, Section and quarter section.

2. EXECUTIVE SUMMARY, PAGE 1

Although Waste Facility 1 may be the principal source of groundwater contamination, investigation results indicate that other sites have contributed also.

Response: The TCE concentration found in these other sites are low relative to the concentrations observed at Waste Facility 1. Therefore, these other waste facilities are not considered to be as significant as Waste Facility 1. These findings are expanded upon in Chapter 2, pages 2-12 to 2-18 of the RI.

The author should introduce the geologic units and the subunits before discussing groundwater quality impacts and implications.

Response: This section is used for presenting significant results of the Remedial Investigation; therefore, it is more appropriate to present more detailed definitions and explanations elsewhere. In this case, geologic information is discussed in Chapter 3, Section 3.2.1, pages 3-5 to 3-9 of the RI.

Although Subunit A contains groundwater with high TDS and TCE contamination, it is still classified as a drinking water aquifer and is protected for drinking water use by the Environmental Quality Act, Arizona Revised Statutes (A.R.S.) Title 49-224.B. (In order to reclassify an aquifer, ALL of the following criteria must be met: the aquifer is hydrologically isolated, water from the aquifer is not being used as drinking water, and the short and long term benefits to the public in degrading the aquifer significantly outweight the short and long term costs to the public of such degradation.)

Response: Subunit A is classified as a Class III aquifer and health-based cleanup levels are not appropriate for a Class III aquifer. Therefore, the existing quality of Subunit A groundwater is unsuitable as a drinking water supply and for most agricultural purposes. Additionally, the Arizona law referred to is not considered an ARAR; see our comments on this issue dated August 1, 1989.

If Subunit B possesses lower permeability, then how did Subunit C become contaminated?

Response: The text states that Subunit B "inhibits", not stops, vertical migration of ground water. It is still possible that contaminated ground water may migrate from Subunit A through Subunit B into Subunit C although at a reduced rate.

Subunit C IS a drinking water source (rather than a potential source as stated in the text).

Response: Comment noted. Subunit C is not currently used for drinking at the location where contaminants are detected. Therefore it is a potential source at that location. The text will be revised from: "The shallow ground water is separated from a potential drinking water aquifer (Subunit C) by a zone of lower permeability geologic materials (Subunit B)." to "The shallow groundwater is separated from drinking water supplies (Subunit C) by a zone of lower permeability geologic materials (Subunit B)."

City of Goodyear (COG) wells located within 500 feet of UPI's property boundary produce groundwater for public water supply. These COG wells draw water from the Middle Fine-grained Unit (MFU). Consequently, the MFU is a CURRENT source of drinking water NOT a potential source.

Response: Comment noted. The text will be revised from "The Middle Fine Grained Unit Beneath Subunit C is also a potential source of drinking water in the area." to "The Middle Fine Grained Unit beneath Subunit C is also a source of drinking water in the area."

3. EXECUTIVE SUMMARY, PAGE 2

The groundwater objectives should include the restoration of the aquifer to meet ARAR's. ARAR's include not only federal water quality standards, but also the State of Arizona environmental quality laws and aquifer water quality standards.

Response: Comment noted. Arizona laws are not considered ARARs for this site. See our legal comments dated August 1, 1989.

Evaluation, screening and selection of remedial action objectives and alternatives for groundwater and soils should have been performed separately. (The combination of soil and groundwater alternatives weakens the overall choices.)

Response: The separate options for groundwater and soil treatment were evaluated and screened separately in Chapter 5 of the FS. Remedial alternatives were presented in Chapter 6 of the FS as Alternatives A-1 for ground water treatment only and as Alternative A-2 for soil treatment only.

Alternative A-4 includes pumping and treating groundwater with concentrations above 100 ppb TCE. How was this 100 ppb target achieved? Target clean-up areas should be defined by concentrations above background and ARAR's.

Response: Estimates predict that reducing the TCE concentration to 100 ppb in Subunit A will protect Subunit C from TCE contamination. Therefore, the scope of this alternative was not that of Subunit A remediation but that of Subunit C protection. See Chapter 5, Section 5.2.14, pages 5-8 to 5-9 of the FS.

Why does the heading for Alternative A-4 include a pumping rate? Including a pumping rate for this alternative but not the others is inconsistent. Pumping rates for the alternatives should be determined based on the desired time for restoring the aquifer, the number of wells to be pumped, and the target areas.

Response: Alternatives A-0 through A-3 use no action or air stripping (should MCLs be exceeded) treatment for withdrawal at point of use. Alternatives A-4 pumps ground water at a rate of 400 gpm from Subunit A using extraction wells, while the withdrawal rate of Alternatives A-0 through A-3 are dependent upon production well capacities.

The heading for Alternative A-4 mentions re-injection but the text beneath the heading does not include re-injection. In addition, why does Alternative A-4 specify a particular treatment method rather than just treatment in general. Either more alternatives should be included here and each alternative should specify methods of treatment for soil and groundwater, or the alternatives outlined here should be generic. Alternative A-4 suggests the use of production wells. Should the term "production well" be replaced with the term "extraction" wells or is the text referring to municipal and domestic supply wells?

Response:

- Reinjection is listed in the text beneath the heading (See Executive Summary, Page 3, Paragraph 2, Bullet 2 of the RI).

- As the text points out, the remedial alternatives that are listed in the Executive Summary are those that survived the screening process detailed in Chapters 4 to 6 in the FS. Since this is a summary of the alternatives most likely to be used it would be inappropriate to list all possible treatment methods. To retain consistency, air stripping should also be mentioned.

- Comment noted. The text will be revised from "Removal would take place via production wells and treatment would be accomplished with air stripping." to "Removal would take place via extraction wells and treatment would be accomplished with air stripping."

4. **EXECUTIVE SUMMARY, PAGE 3**

This document should evaluate the potential alternatives rather than argue for a preferred or "recommended" alternative.

If the author insists on stating arguments for recommended alternatives, then please note that the No Action Alternative is not considered an acceptable alternative. No Action would not satisfy state ARAR's nor would it be protective of human health and the environment.

Response: The purpose of the RI/FS is to present the methodology used in the development of the remedial investigation and feasibility study as outlined by the Superfund program. As stipulated by EPA, the FS presents remedial alternatives which must undergo an evaluation methodology that satisfies certain criteria. The Executive Summary merely summarizes the results of the screening and evaluation process and presents a recommendation for consideration by EPA for approval, adjustment or reinjection. This applies also to the No Action alternative. The No Action alternative is suitable as a recommended alternative for consideration since the response action incorporates monitoring activities and implementation of institutional controls for groundwater withdrawal from Subunit C and the MFU for drinking water supply and maintaining the existing non-applicable use of Subunit A groundwater. Institutional controls, such as mandated screening depths within Subunit C and the MFU, would ensure continued protection of human health and the environment and thus, may be waived from ARARs.

5. CHAPTER 1, PAGE 1-2, PARAGRAPH 2 (LAND USE)

This paragraph is awkward. Are you referring to the use of land that is adjacent to the site? (Suggested wording: The land adjacent to the PGA site is used for residential, commercial, and agricultural purposes.)

Response: We find the meaning of this paragraph to be straightforward. The text is stating that land uses adjacent to the UPI site are for various purposes including residential, commercial and agricultural.

6. CHAPTER 1, PAGE 1-2, SECTION 1.2.3, PARAGRAPH 1

Inorganic contamination should be addressed in this section. (Currently, the text only discusses VOC contamination.)

Response: The subject of inorganic contamination is addressed in Chapter 1, page 1-3, Section 1.2.3, Paragraph 3 of the RI.

7. CHAPTER 2, GENERAL COMMENT

The units of concentrations listed in the text are inconsistent with the units used in the tables. This practice makes comparison between the text and the data very difficult. In addition, the use of different formats and order of presentation between the various tables makes comparison difficult.

Response: Concentration units have consistently been presented in terms of ug/kg for organic, metal, pesticide, and Total Petroleum Hydrocarbon chemical species. The two exceptions to this general statement occur in Chapter 2, Page 2-21, Section 2.3.3, Paragraph 3 of the RI and in

Chapter 2, Table 2.11 of the RI. This was done not to make the reading more difficult but was done in order to facilitate comparison of test results to federal standards.

8. CHAPTER 2, PAGE 2-2, SECTION 2.2.2, PARAGRAPH 1

The second bullet of paragraph one is awkward. (Suggested wording: Evaluate past disposal points which represent potential sources for groundwater contamination.)

Response: Comment noted.

9. CHAPTER 2, PAGE 2-3, PARAGRAPH 2

Figure 2.2 includes a description of the waste disposal areas. Including Figure 2.2 as a point of reference for the waste facilities and sampling locations would be helpful.

Response: Comment noted.

10. CHAPTER 2, PAGE 2-5, SECTION 2.2.2.3, PARAGRAPH 3

Providing a list of the compounds that were identified during the interviews would be useful.

Response: The compounds are: calcium chromate, iron powder, titanium, magnesium, mercury, lead oxide, barium chromate, lead chromate and tungsten. This list is found in Chapter 2, Page 2-19, Section 2.3.3, Paragraph 2 of the RI.

11. CHAPTER 2, PAGE 2-5, SECTION 2.2.2.3, PARAGRAPH 4

Please provide a description of the "hot-gas" pesticide application method. When was it used?

Response: The hot gas dissemination process is discussed in the "Revised July 31, 1987 Soil Sampling Plan for Unidynamics Facility". A device was used to disperse materials carried in hot gases.

The process was tested between the time periods: 1964-1970 (dyes) and 1968-1969 (pesticides).

12. CHAPTER 2, PAGE 2-6, PARAGRAPH 2

Please explain why samples obtained from the reactive waste storage area were only analyzed for total petroleum hydrocarbons. Were other analytical methods used? What "reactive" wastes were stored in this area?

Response:

- o The "Revised July 31, 1987 Soil Sampling Plan for Unidynamics Facility" lists three analytical suites for Waste Facility 9 in Table 6.6. These are total petroleum hydrocarbons (EPA 418.1), total metals and EP-TOX metals.

- o Various chromate, nitrate, perchlorate and oxide compounds are assumed to compose the "reactive wastes".

13. CHAPTER 2, PAGES 2-11 TO 2-18, SECTION 2.3.2

Although concentrations of VOC's in the soils vary among the potential disposal areas, the presence in the soils is so widespread that all the designated waste disposal facilities are probably potential sources of groundwater contamination. VOC concentrations detected at depth in the soils may be more an effect of the disposal method (into dry wells) than the result of off-gassing from the contaminated groundwater.

Response: The remedial investigation recognized the potential of various waste disposal areas contributing to the groundwater contamination. However, certain indicators, such as; depth of contamination versus depth of disposal facility; soil properties and mechanics and; available historical accounts, substantiate the assertion that most of these facilities, although potential contributors, are not significant contributors and that the widespread presence of VOC contamination is the result of off-gassing from the contaminated groundwater. For location specific discussions, see responses to comments 17, 18, 19, 20 and 21.

14. CHAPTER 2, PAGE 2-12

Are the construction details of the dry wells known (I am especially interested in the depth and perforated intervals)? Are the "vaults" the same as the concrete sedimentaiton tanks? Please describe the design details of both (if they are different).

Response: The design details, such as depth and perforated intervals, are not currently known for the drywells, sedimentation tanks or vaults. The vaults are not the same as the sedimentation tanks but refer to the below grade collection facilities which contain stainless-steel 55-gallon drums, located adjacent to Buildings 1 and 6.

15. CHAPTER 2, PAGE 2-12, SECTION 2.3.2.1

What were the sampling intervals for Waste Facility 4 and which samples were analyzed? (See the comment below in regard to Table 2.4)

Response: The analyzed samples were taken from depths of 10, 20, 30, 40, 50, 60 and 70 feet below land surface. This information is presented in Chapter 2, Table 2.3 of the RI.

16. CHAPTER 2, TABLE 2.3 AND 2.4

Using the same format for the two tables listed above (especially in regard to sampling intervals and analysis of samples) and presenting the same types of data in the two tables would make comparing the tables and tracking the samples easier for the reader.

Response: Comment noted.

17. CHAPTER 2, PAGE 2-13, SECTION 2.3.2.1.

PARAGRAPH 2, LAST SENTENCE
Would a clear maximum in TCE concentration be expected in a heterogeneous soil profile?

PARAGRAPH 3, LAST SENTENCE
Can the conclusion be made that the "low" concentration of TCE found in the subsurface is directly related to the amount of TCE disposed in a dry well? Other factors are at work and could affect the TCE concentrations (i.e. time and the potential for both lateral and vertical migration away from the dry well.)

Speculation that TCE is "off-gassing" from the water table is unsubstantiated. First, if TCE is partitioning to soil-gas and migrating upward, then TCE concentrations in soil samples should reflect the process. Second, if in partitioning is occurring, then one would expect to find the highest concentrations of TCE at the water table and gradually decreasing all the way up towards the surface (dissipating upwards). Soil boring results seem to suggest varied concentrations at different depths (no definite depth/concentration correlation) and possibly indicate preferred zones of migration (as might be expected from disposal in a dry well and downward migration of fluid). Third, if off-gassing is occurring one might expect to find similar patterns of contaminant concentration in all the borings. Finally, even if TCE is partitioning and migrating from the water table, it still constitutes a zone of soil contamination that requires evaluation and consideration.

Also, dry wells usually discharge through a perforated pipe located below a ten to fifteen foot deep settling chamber (and the upper portion of the casing is not always perforated). Consequently, contamination resulting form dry wells would tend to occur below the upper fifteen or twenty feet of soil.

LAST PARAGRAPH
Switching units from micrograms per liter to micrograms per cubic centimeter causes unnecessary confusion.

Response: Chapter 2, Page 2-13, Section 2.3.2.1, Paragraph 2, Last Sentence

The sentence hypothesizes the existence of three phases in the soil media: soil vapor, sorbed TCE coating soil particles and aqueous phase with dissolved TCE. Even within a heterogeneous soil profile the amount

of contaminant per volume of soil ascribed to the solvent phase or aqueous phase could vary.

For example, consider the case of an aqueous phase contaminated with TCE moving downward through the soil. This phase moves through the soil due to capillary action and/or gravity. This phase does not simply drain through the soil because the liquid can be held by the soil pores through surface tension. When a column of water is not heavy enough to overcome the surface tension of the soil pore it cannot move downward any further. This would be a "front" at some percentage of soil saturation called the irreducible saturation. The soil near the retained liquid would have some of the liquid sorbed onto the soil surfaces. The amount of contaminant sorbed onto the soil would be significantly less than the contamination at the "front." The contamination at the front would represent a clear maximum concentration if a profile were composed.

Paragraph 3, Last Sentence

- Comment Actually references pp. 2-13 to 2-14

- The concentration must be related to the amount of TCE disposed in a dry well because of the principle of conservation of mass. There are mechanisms that cause the migration of contaminants in the subsurface. Many of these are in turn driven by amount (surface tension, dissolving in soil water) and concentration (diffusion). The extent to which these mechanisms play a role in migration is dependent on amount and concentration. Greater amounts and higher concentrations indicate greater migration potential. Therefore, it appears that low measured concentrations are related to lesser disposed amounts.

- Regarding the attribution of TCE observations to off-gassing:

  - Generally TCE concentrations do reflect the process of volatilization from the ground-water surface. The highest TCE concentrations were observed at depth for borings in near Waste Facilities 3, 5, 8, 7, 10, and Buildings 11 and 19, and the Drum Storage Area. In these borings TCE was observed at higher concentrations nearer the water table or were only detected near the water table.

  - The text presents that variations in TCE concentrations in Boring 04A could be attributable to variations in soil properties such as porosity, density, and permeability (Page 2-13, para 2).

  - The near uniform nature of contamination in Boring 04A could be attributable to the soil vapor achieving equilibrium with the contaminated ground water throughout the soil column. This process would take an undetermined amount of time. This process would be comparable to placing a bottle of cologne in one corner of a closed room. Even with no air currents, the concentration of cologne would eventually be the same throughout the room.

- The PGA soils sub-committee has not yet determined appropriate soil clean-up standards. Evaluation and consideration of soil contamination emanating from the ground water is not currently justified by State action levels. The concentrations are below state action levels.

o The typical dry well design at Unidynamics' facility located the discharge approximately 30 feet below ground surface.

o Comment noted regarding change of units in last paragraph of section.

18. CHAPTER 2, PAGES 2-15, SECTION 2.3.2.2

PARAGRAPH 1
Table 2.1 indicates that Waste Facilities 3, 5, and 8 were associated with dry wells. Higher concentrations at depths of 60 feet probably result from the injection through the dry wells rather than off-gassing.

Response: Chapter 2, Figure 2.2 of the RI approximates the depth of the dry wells for Waste Facilities 3, 5 and 8 as 30 feet. The VOC concentrations as a function of boring depth is listed in Chapter 2, Table 2.8 of the RI. If the theory that the organic concentrations are a result of injection through the dry wells is accurate, then it would be expected that some organics would be detected in the 30-50 feet boring depth range. Since Table 2.8 clearly points out that detection of organic compounds occurs only at depths greater than 50 feet, the assumption that higher concentrations are a result of injection through the dry wells is probably inaccurate.

PARAGRAPH 2, LAST SENTENCE

The waste facilities discussed consist of sedimentation tanks connected to dry wells. The occurrence of TCE at depth is probably the result of this disposal. If no surface spills occurred, then why would shallow contamination be expected?

Response: If TCE detection in the soil borings was a result of contaminant disposal through dry wells rather than off-gassing from contaminated ground water then TCE should have been discovered in shallower depths for the same reasons as those listed above. Since this does not seem to be the case, this assumption should be dismissed.

19. CHAPTER 2, PAGE 2-16, SECTION 2.3.2.3.

Low levels "indicate" that this facility is not a source of groundwater contamination? The low levels may "suggest" that the facility is not a source but they do not indicate so. The text does not substantiate the conclusion.

Response: Soil borings from Waste Facility 7 were submitted for VOC analysis for depths of 10, 20, 30, 40, 50, and 60 feet below land surface (see Chapter 2, Table 2.4 of the RI). The results are presented in Chapter 2, Table 2.8 of the RI and indicated that only 1,1,1-TCA is present and only at a depth of 10.0-11.5 feet below land surface. No

other organic compound is found at any other analyzed depth. If this facility were to be a ground water contaminant source, than a 1,1,1-TCA concentration gradient would be present throughout the soil boring. Since this is not the case, the conclusion is correct that the data in the text indicates that Waste Facility 7 is not a source of ground water contamination.

20. CHAPTER 2, PAGE 2-16 AND 2-17, SECTION 2.3.2.4

If TCE or TCA were detected in every interval from 10 to 50 feet, than this facility represents a potential source of groundwater contamination.

Response: The text reads: "This facility is probably not a significant source of VOCs in ground water". This statement does not eliminate this facility from being considered as a potential source of ground water contamination. It asserts that this facility is not a significant source of ground water contamination.

21. CHAPTER 2, PAGE 2-17, SECTION 2.3.2.6, PARAGRAPH 2

SENTENCE 2

Define "low" as used in this sentence. Use of an actual concentration range would add clarity to the text. Presumably, concentrations were above detection levels, but were they below 500 ppb?

Response: Laboratory results for soil borings 19A-C are listed in Chapter 2, Table 2.8 of the RI. TCE concentrations range from 147-1480 ppb at soil depths of 20-40 feet below land surface. The highest detected concentration of TCE is relatively low when compared to the concentrations detected in Waste Facilities 1 and 4.

Higher concentrations of TCE at depth may also be a manifestation of disposal through a dry well.

Response: As stated in the text, Building 19 is located near Waste Facility 1. Waste Facility 1 is comprised of 4 dry wells (see Chapter 2, Figure 2.2 of the RI). The disposal of solvents into these dry wells has resulted in ground water contamination at TCE levels exceeding 100,000 ug/kg which in turn has led to the discovery of TCE in Boring 19A-C due to off-gassing of contaminants from the groundwater.

Therefore, to state that higher concentrations of TCE at depth may also be a manifestation of disposal through a dry well is unnecessary and redundant since this has already been shown to be true.

22. CHAPTER 2, PAGE 2-18, SECTION 2.3.2.7

Attempting to guess the concentration of the source seems pointless since the volumes of material disposed are not even known. In addition, the suggestion that rainwater filtering through empty drums constituted the original source is unsubstantiated and represents pure speculation.

Response: Concentration values were not "guessed" at, they were scientifically determined using EPA Method 8010/8020 at an approved laboratory. Second, it is not necessary to know the original volume of disposed material in order to determine concentration within the soil.

23. CHAPTER 2, PAGE 2-18, SECTION 2.3.2.8

If contamination is present, then its a potential source. What was the range of concentration detected?

Response:

- The text does not dismiss the solvent collection area as a potential contamination area. It states that these areas are not significant ground water contamination sources.

- Chapter 2, Table 2.8 of the RI lists concentration ranges for the following chemicals (note: no distinction is made between boring or boring depth):

Compound	Concentration Range (PPB)
TCE	89-4260
1,1,1-TCA	12-10800
Ethyl Benzene	563
Xylene	743-4600

24. CHAPTER 2, PAGE 2-19 to 2-21, SECTION 2.3.3

The presence of high concentrations of metals in selected soil samples may not be anomalous or be disregarded. Instead, they may be indicative of a problem in a fairly limited area.

Response: The text does not disregard results from soil samples as being anomalous. The discussion concerning barium and aluminum concentration results (Chapter 2, Page 2-20, Section 2.3.3, Paragraphs 2 and 3) states clearly that the samples from a tank (for barium) and from within a pond (for aluminum) were not representative of soil concentrations. Only these were considered anomalous and disregarded. It was never implied that a problem could not exist within a limited area.

25. CHAPTER 2, PAGE 2-20, PARAGRAPH 3

It's a little too convenient to say, "...the consistent occurrence of arsenic in soils at UPI facility above background determined for the airport at the southern part of the study area probably indicates that background concentrations at Unidynamics facility may be generally higher than for the airport." Unidynamics is locate less than one mile from the airport. It seems unlikely that two sites located less than one mile apart possess different ambient soil values for arsenic. This sentence is misleading.

Response: There are several circumstance which support the text's contention that arsenic background concentrations may differ for soils at the UPI and PGA sites.

1) A review of manufacturing processes and interview results indicated that arsenic was never used at this site. For this reason, arsenic should not have been detected unless it was a component of the ambient soil.

2) Soil sampling was performed at Waste Facilities 2, 3, 5, 6, 8, 9, 10, and 11. The results are listed in Chapter 2, Table 2.9 of the RI. The mean concentration of arsenic was calculated to be 21.6 ppm with a standard deviation of 7.6 ppm. There did not seem to be any relationship between soil depth and arsenic concentration. This analysis showed that the arsenic concentration within and throughout the soil remained fairly constant giving credence to the theory that ambient soil conditions (at least for arsenic) for UPI and PGA may indeed be different.

3) The assumption that arsenic concentration soil levels at UPI are the result of arsenic disposal is not supportable. If this assumption were to be true then it would be expected that an unusually high level of arsenic would be found at one or two locations (as was the practice of TCE disposal). Instead, the evidence points to a low, constant level of arsenic throughout the site. This would lead away from the idea of the higher UPI background results being a consequence of UPI disposal and toward the idea that there is a naturally occurring level of arsenic that is higher at the UPI site.

26. CHAPTER 2, PAGE 2-21, PARAGRAPH 2

Were samples obtained just from within the tank or were they obtained from around and below the tank? It is not clear in the text. With such high values, was the possibility of tank leakage addressed in the sampling?

Response: As stated in the text, Stage II samples exhibiting the highest concentration of the various metals were selected for EP toxicity analysis of priority pollutant metals. These samples are listed in Chapter 2, Table 2.11 of the RI. The location feature that is sampled is identified from the sample designation using Chapter 2, Table 2.2 of the RI.

Sample Designation	Feature Sampled
Sample B Sample C	Building 11 - Borings at Front of Building
8A	Waste Facility 8 - Boring at Dry Well
10A	Waste Facility 10 - Boring at tank
7A 7B	Waste Facility 7- 2 Borings in Leach Field

The Phase III Sampling Plan is summarized in Chapter 2, Table 2.4 of the RI. This table reveals that samples were analyzed for boring depths that were below the level surface. (Stage I Samples, as described in Chapter 2, Page 2-4, Section 2.2.2.2. of the RI, are those from inside the tank).

From all of this information, the question should be addressing Sample 10A only. Again, referring to Chapter 2, Table 2.11 of the RI the EP Toxicity Test Results for this sample for each metal of interest are listed below (unit are ug/l):

Arsenic	< 0.5	Lead	< 0.1
Barium	< 1	Mercury	< 0.01
Cadmium	< 0.1	Selenium	< 0.5
Chromium	< 0.1	Silver	< 0.1

Interpretation of this data reveals that the highest detected metal, barium, has a concentration that is less than one percent of the Federal EP Toxicity standard of 100 mg/l. Groundwater quality date coupled with the EP Toxicity data indicates that the soil at this particular location has a low metal concentration and does not serve as a source of metals to ground water. Therefore, the possibility of tank leakage need not be addressed in this sampling.

27. CHAPTER 2, PAGE 2-21, PARAGRAPH 3

What about the concentration of metals in relation to ADHS health-based soil clean-up levels? Although not promulgate, the clean-up levels still constitute a "to be considered" (TBC).

Response: In our previous comments we demonstrated why assumptions behind the ADHS numbers are not similar to circumstances at the site; hence, as TBCs, the are not useful.

- The ADHS - suggested health-based clean up levels for metal contaminants are listed in Chapter 2, Page 2-37, Table 2, Vol. I (Public Comments Draft) of the RI/FS. Seven metals within the UPI site have been found to have soil concentrations that exceed average background levels analyzed in soil samples at the PGA site: arsenic, barium, aluminum, mercury, lead, chromium and zinc (see Chapter 2, Page 2-19 of the RI).

- There do not appear to be any ARARs that are directly related to metal contaminants in soils at the UPI site. And, as was pointed out, ADHS health based soil clean up levels may be (but are not now) adopted at some time in the future in the State of Arizona.

28. CHAPTER 2, PAGE 2-21, SECTION 2.3.4

Background concentrations of dieldrin and chlordane would need to be determined before these concentrations are attributed to agricultural use only.

Response: Comment noted.

29. CHAPTER E, PAGE 2.22, SECTION 2.4

1st billet- This is only true for 4,4'-DDE.

Response: Comment noted.

4th billet- Table 2.1 lists a number of locations where disposal of solvents occurred into dry wells. Therefore, unless these solvents did not include TCE, distinct evidence does exist that TCE disposal to soils occurred at these other locations.

Response: Since no records were kept of the solvent waste disposal system at UPI, it is impossible to speak with absolute confidence as to which location a particular solvent was discarded. Therefore, inferences must be made based upon soil boring analysis. The Waste Facilities which could have conceivably received waste TCE are numbers 1, 2, 3, 4, 5, 6, 7, 8, 10 and 12, Buildings 11 and 19, Drum Storage Areas A and B, and Solvent Collection Areas A, B, C and D. No TCE was detected in Waste Facilities 2, 7 or 8, nor in Building 11 (Chapter 2, Table 2.8 of the RI) so these can be eliminated. Waste Facilities 3, 5, and 6 contain TCE concentrations only at depths below 60 feet and in quantities that are most likely the result of off-gassing from contaminated ground water and not migration from a dry well (Chapter 2, Pages 2-15 to 2-16, Section 2.3.2.2 of the RI). The TCE concentrations found at the remaining sites, Waste Facilities 4, 10 and 12, and the Drum Storage and Solvent Collection Areas, may or may not be a result of disposal to the soil. However, the concentrations are low (compared to Waste Facility 1) so that no definitive judgment can be made. Therefore, unless distinct evidence (i.e. written records, verbal confirmation, etc.) can be found, then the statement in the RI stands.

last billet- The presence of 1,1,1-TCA in groundwater beneath the facility indicates that its presence in the soil was significant enough to impact groundwater.

Response: The text reads: "concentrations of TCA in soil are not a significant source to groundwater". TCA concentrations in the soil (or in Subunit A groundwater) are insignificant when compared to TCE concentrations. Since the methods used in treating TCE are also successful in treating TCA, the relatively small concentrations of TCA will not need to be considered in the design of the treatment process. This is the justification for the comment in the RI.

30. CHAPTER 3, PAGE 3-1, SECTION 3.1.1, PARAGRAPH 1

Please provide well completion data for monitoring wells 1-4.

Response: The available well completion data for monitoring wells 1-4 is found in Chapter 3, Page 3-19, Table 3-10, Vol. I (Public Comments Draft) of the RI/FS.

31. CHAPTER 3, PAGE 3-3, (LAST BILLET)

The Phase II report stated that a Cement Bond Log was run on MW-14, but the log is not included here. Was the log run but just excluded? Or is the statement incorrect?

Response: The log was run but was excluded.

32. CHAPTER 3, PAGE 3-3, LAST PARAGRAPH

If well 33dcd is an integral part of the monitoring network, then why isn't water quality data for this well included in Appendix D? Although it is stated that 22 wells were sampled during the remedial investigations, no data is included for any wells other than the UPI monitor wells.

Response: Well 33dcd was sampled and monitored by EPA. Likewise, the other wells (not included by UPI) are included under EPA's reports.

33. CHAPTER 3, PAGE 3-8, LAST PARAGRAPH

This site is underlain by several thousand feet of alluvial sediments.

Response: Comment noted.

34. CHAPTER 3, PAGE 3-10, LAST PARAGRAPH

Subunit B does not hydraulically separate Subunits A and C.

Response: Subunit B is comprised mainly of finer-grained material. Because of this finer-grained material, Subunit B has a lower permeability and hydraulic conductivity than that of either Subunit A or Subunit C. Vertical and horizontal velocity gradients from Subunit A to Subunit C are impeded because of Subunit B. This condition defines a hydraulic gradient.

35. CHAPTER 3, PAGE 3-15, LAST PARAGRAPH

TDS concentrations in on-site Subunit A monitor wells are significantly higher than in off-site wells. Water quality types are different on-site and off-site. Therefore, it is likely that the facility activities have had significant impacts on inorganic water quality in addition to the historic agricultural activity in this area.

Response: The observed variations in TDS concentrations and water quality types may have origins other than facility activities. The wells are widely spaced and the observed variation may be a result of natural variability. Off-site wells are generally deeper than on-site wells and the variability may be related to this difference in depth. MW-1, an upgradient well on site contains the same general TDS and water quality type as monitor wells on the facility. This indicates that "facility activities" are not responsible for the variability observed.

In addition, interviews and a review of operations did not reveal any processes that would have a "significant impact on TDS or water quality types.

36. CHAPTER 3, PAGE 3-18, PARAGRAPH 3

No data is presented to support changing TCE concentrations with time. A series of figures with actual TCE concentrations over time would be more useful than the mean concentration values presented in Figure 3.13.

Response: Comment noted.

37. CHAPTER 3, PAGE 3-18, PARAGRAPH 3 (Subunit A)

Is there a possible explanation for the rise in the TCE concentration for monitoring well MW-12?

Response: Yes, MW-12 is in the plume, downgradient of the source, screened only in Subunit A.

38. CHAPTER 3, PAGE 3-19

PARAGRAPH 1

What is the source of TCE concentrations in well SC4A if not necessarily attributable to TCE in Subunit A? Does this mean that Subunit C is contaminated at this location?

PARAGRAPH 2

By not providing waste quality analysis over time, it is difficult to substantiate the statement that TCE concentrations in MW-6 do not indicate a rising trend in concentrations. A TCE concentration of 6 micrograms per liter at MW-6 exceeds MCL's for TCE.

Response:

- Subunit C is not likely to be contaminated at this location, this is a typo and Subunit A in the last sentence should be Subunit C.
- The text states that the agricultural production well SF4A is screened in both subunits A and C.
- Within the well SF4A, water from subunits A and C would be mixed. Subunit A water would be diluted with subunit C water.

Paragraph 2

- Measured values fluctuating between 2.0 and 6.0 mg/l are interpreted to represent the inherent variability in sampling, handling and analyses accuracy since no apparent trend is discernable.

42. CHAPTER 3, PAGE 3-19, LAST PARAGRAPH

The rationale here seems to be that since the well only serves a warehouse, its not important. First, it supplies a warehouse which employs approximately 280 employees. Second, the water pumped from COG #10 provides the business with water that is utilized in food processing. Third, the exclusivity of the aquifer is inconsequential to the regulatory need for protection. All aquifers in the state (unless otherwise reclassified) are protected by statute for drinking water use. (Also, the density of TCE could affect its movement into the B/C aquifer.)

Response:

- The heading of the comment should be Chapter 3, Page 3-20, Paragraph 1.
- No judgment of the well and importance is implied or intended. The well is not used in food processing. Food warehousing nearby does not require the use of water for storage.
- The Arizona law (referred to) is not considered an ARAR, see our legal comments dated August 1, 1989.

43. CHAPTER 3, PAGE 3-20, SECTION 3.2.4

Although drinking water is available from the aquifers deeper than those already affected by VOCs, it is not reasonable to require the drilling of deeper wells to acquire this water. Additionally, no data is available to determine if the MFU and/or LCU beneath the UPI site have been affected by VOC contamination.

The implication in this section is that drinking water supply wells are not located in an area that could be impacted by the VOC contamination from Unidynamics. However, there are City of Goodyear wells located within 500 feet of UPI's property boundary. These wells consistently detect TCE contamination.

Response: While it is true that no VOC contamination data is available for the MFU and/or the LCU underlying the Unidynamics site, this does not preclude investigation of (its) possible use. This is especially true when the fact that TCE is not detected in the MFU at other locations.

There is one well (COG #2) located within 500 feet of the Unidynamics site. Groundwater data from this well is found in Chapter 3, Table 3-4 of the RI/FS (Public Comments Draft). According to this table, the average TCE concentration for this well and City of Goodyear wells 1, 3, and 6 is less than 1.5 ppb, well below the 5 ppb MCL. The location of COG #2 is not within the known boundary conditions of the Unidynamics' groundwater gradient. It can reasonably be concluded that Unidynamics has not contaminated this particular well. Therefore, to assert that

VOC contamination from Unidynamics has an impact on drinking water just because a well is located within 500 feet of the facility boundary is not borne out by the detection results.

44. CHAPTER 3, PAGE 3-21, FIRST PARAGRAPH

The presence of VOC contamination in Subunit C indicates that Subunit B does not act as a hydraulic barrier between Subunits A and C.

Response: Comment noted. In the text, "hydraulic barrier" was replaced with "to inhibit movement of groundwater". This revision appears in the 5/4/89 version; the most recent document.

45. CHAPTER 3, PAGE 3-22, SECTION 3.3.2, FIRST SENTENCE

This sentence implies that the Subunit A aquifer is not considered a drinking water source. Either change the sentence or qualify the paragraph by stating that state law designates all aquifers for drinking water use.

Response: See response to Comment 2.

46. CHAPTER 3, PAGE 3-22, FIRST PARAGRAPH

The higher TDS concentrations in Subunit A on-site as compared to off-site indicate influences in addition to the historic deep percolation of irrigation return flow.

Response: Comment noted. See response to Comment 35.

47. CHAPTER 3, PAGE 3-22, SECTION 3.3.2

SUBUNIT C

First, meaning of the work "poor" is unclear as used in this sentence. Either define the word or restate the sentence. Second, whether the aquifer is suitable for drinking water is irrelevant to the need for remediation.

Response: Comment noted. The text goes on to state that TDS exceed the recommended secondary drinking water standards and that nitrates approach the drinking water limit. Therefore, it is appropriate to state that the quality of Subunit C, although suitable for drinking water supply, is still poor.

LAST PARAGRAPH

Concentration may suggest that Subunit B impedes downward movement of contaminants, but they do not necessarily indicate so. (Otherwise Subunit C would not be contaminated)

Response: Although Subunit B may be an impediment to contaminant migration, it is still possible for contaminants that were originally in Subunit A to be found in Subunit C. An impediment is a hindrance to migration, not a complete barrier. See response to Comment 2 also. Wells which are screened in both Subunits A and C provide a gravity conduit by which Subunit C can be contaminated from Subunit A.

48. CHAPTER 3, TABLE 3.1

This table is illegible.

Response: Comment noted.

49. CHAPTER 4, PAGE 4-1, PARAGRAPH 3

TCE is still present in soils not associated with Waste Facility 1. These other soils are probably continuing sources also.

Response:

- The text does not deny the presence of TCE in soils not associated with Waste Facility 1.

- The text does not deny that some of the other soils areas may be continuing sources also (in fact, this may or may not be the case). However, to claim that all other soils are probably continuing sources is too extreme. Technical analysis using the results of soil borings for Waste Facility 3, 5 and 6 (Chapter 2, Pages 2-16 to 2-17, Section 2.3.2.2 of the RI) asserts that soil contamination is the result of off-gassing from ground water contamination (see response to Comment 18). In addition, Building 11 (Chapter 2, Page 2-17, Section 2.3.2.5 of the RI) and Building 19 (Chapter 2, Pages 2-17 to 2-18, Section 2.3.2.6 of the RI) do not appear to be contributing to ground water contamination based on collected data.

50. CHAPTER 4, PAGE 4-1, LAST PARAGRAPH

Strike the first sentence and replace the word "impedes" with "hinders" or "slows" in the next to last sentence.

Response: Chapter 2, Table 2.1 of the FS is a summary of the organic compounds detected in Subunit C. From this table, the range of TCE concentrations found in Subunit C is 0.7-5.5 PPB. This substantiates the statement that TCE is generally confined to Subunit A, and that the term "impedes" is synonymous with the term "hinders" or "slows". Therefore, it is unnecessary to revise the text.

51. CHAPTER 4, PAGE 4-2, FIRST PARAGRAPH

The Environmental Quality Act protects all aquifers as drinking water sources.

Response: See Response to Comment 2.

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CRANE UNIDYNAMICS/PHOENIX

FILE PGA 2.1

UNIDYNAMICS/PHOENIX • POST OFFICE BOX 46100 • PHOENIX, ARIZONA 85063-6100

2 August 1989

Mr. Jeff Rosenbloom, Chief
Enforcement Programs Section
United States Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, California 94105

RE: Response to CH2M Hill comments - Unidynamics RI/FS Report

Dear Jeff:

Enclosed per your request are Unidynamics' responses to CH2M Hill's comments on our RI/FS.

If you have any questions, please contact me at 602/932-8245.

Very truly yours,

W. C. Donahue
Director
Human Resources

WCD/dl

Enclosures

xc: M. Corash
F. Stephenson
G. Seifert
T. Ungerland

1000 NORTH LITCHFIELD ROAD • GOODYEAR, ARIZONA 85338-1295

RESPONSE TO CH2M HILL COMMENTS

1. Groundwater Alternative GW-A.1: The maximum predicted drawdown under this remedial action alternative is 88 feet. The thickness of Subunit A used in the simulation was 90 feet. In an unconfined aquifer, the maximum "safe" drawdown for an extraction well field is 50 percent of the aquifer saturated thickness. This is to account for possible aquifer heterogeneity or subsequent water level fluctuations. Clearly, the withdrawal of 1,000 gpm from this aquifer would cause extensive dewatering. If the pumped water were reinjected after treatment, the drawdown would be reduced, but that process is not taken into account in this alternative. An analysis of the capture zone estimate was not made since this alternative cannot be successfully implemented.

   Response: We agree that substantial drawdown of the water table would occur under this pumping scenario and that it may exceed the practical limits of the Subunit A aquifer. This extremely aggressive pumping scenario was included in our analysis in order to provide a range of options for EPA to evaluate as requested. We are pleased that EPA's technical consultant recognizes the limitations of such an aggressive pumping scenario and agree with their conclusion that further consideration of this pumping scenario is not warranted.

2. Groundwater Alternative GW-A.2: The maximum predicted drawdown under this alternative is 126 feet. As stated above, Subunit A has a saturated thickness of only about 90 feet. Therefore, this alternative will also cause extensive dewatering of Subunit A. No evaluation of the capture zone estimate was attempted for the reasons stated above.

   Response: See response to comment #1.

3. Groundwater Alternative GW-A.3: The maximum predicted drawdown under this alternative is about 1.5 feet. Using the well location recommended by Dames & Moore, this pumping scheme will capture only about 15 to 20 percent of the target area we estimate to be contaminated above ARAR levels. If a more suitable well location were chosen, approximately 850 feet to the north of the recommended location, 50 to 60 percent of the target area contaminated above ARAR levels could be captured.

   Response: The "target area" estimated to be contaminated above specified levels by EPA's contractor is subject to a wide variation in extent since TCE above 5.0 ppb has only been detected very infrequently in Subunit C in a well cluster at a single location. One well in the cluster is only partially completed in Subunit C. An almost infinite number of "target areas", as assigned by the EPA contractor in this comment, can be drawn around a single point. However, all such "target areas" may be meaningless since it has not been conclusively shown that Subunit C exceeds ARARs in the vicinity of the plant site where EPA requested that cleanup alternatives be evaluated.

   Dames & Moore selected a different "target area" than the EPA contractor upon which to base its evaluation. This analysis was performed solely at the request of EPA. Given the lack of conclusive data, and the

problems posed by increased drawdown in the area of high Subunit A contamination (as discussed in Unidynamics' letter of July 17, 1989) the proposed cleanup is appropriate.

4. Groundwater Alternative GW-A.4: **The maximum predicted drawdown under this alternative is about 2 feet. Using the well location recommended by Dames & Moore, this pumping scenario will capture only a few percent of the target area we define as being contaminated above background levels. Even with an optimal well location, this alternative will only capture 5 to 8 percent of the target area above background levels. Additional wells pumping at higher rates will be necessary to capture the areal extent of groundwater contaminated above background levels.**

   Response: Please see our response to comment #3 above for a discussion on the problems of technical justification for establishing a "target area" as the EPA contractor has done in framing this comment. There is no conclusive evidence at this time that a representative sample of Subunit C ground water exceeds 5.0 ppb for TCE.

   Unidynamics has discussed in previous comments to the EPA (letter dated July 17, 1989) the potential problems with increasing pumping rates in Subunit C and the increased drawdown associated with the pumping. A careful analysis of the relative position of the hydraulic head in Subunits A and C under any potential cleanup scenario must be completed prior to establishing design criteria for the groundwater extraction system. Failure to consider the potential adverse water quality degradation that may result from the downward migration of contaminants from Subunit A into C as a result of proposed remediation in Subunit C could lead to a remedial action that causes more of a problem than it solves.

5. **The equipment sizing and costs for the groundwater alternatives were not reviewed since by UPI's admission the sizing basis is wrong.**

   Response: Comment not understood. Order of magnitude costs based on preliminary design have been provided.

   Preface to comments 6 and 7:

   Several statements have been made which infer that Unidynamics have failed to "...address the entire range of contaminants at the site..., not just TCE." Please refer to Table 3.6 of the May 4, 1989 RI, where eleven VOCs other than TCE are listed as being detected in monitor wells. The range of concentrations found (in ppb) is also listed in this table.

   In CH2M Hill's comments dated March 23, 1989, comment No. 4 ..."The results for acetone and other organic compounds are not of as much interest because they are not major components of measured ground water contamination at UPI. The exception is MEK which was found at high concentrations at UMW-4". Thus, the level of concern seen in these most recent CH2M Hill comments seems unwarranted.

Furthermore, of the eleven VOCs detected in groundwater in Subunit A, other than TCE, the only VOC detected in any appreciable concentration is Methyl Ethyl Ketone (MEK). MEK is also the only "contaminant" found that is not easily treated, especially by air stripping. Air stripping for removal of TCE will, to a sufficient extent, remove the other "contaminants" as well. Studies performed with "mixtures" of VOCs present in the "ppm" range in feedwater to air strippers showed no effect on the mass transfer of each caused by the mutual presence of the others.

However, due to the presence of MEK, and the potential for traces of other VOCs, remedies beyond air stripping were examined.

6. **The supplements do encompass some additional alternatives for remediation of the site, but they fail to address some of the other shortcomings of the main text. In some cases they contradict the main text. They also suffer from the fact that in many cases they still do not address the entire range of contaminants at the site.**

   Response: In CH2M Hill's comments dated March 23, 1989, comment No. 4 ..."The results for acetone and other organic compounds are not of as much interest because they are not major components of measured ground water contamination at UPI. The exception is MEK which was found at high concentrations at UMW-4." (See response to comment No. 5)

7. **UPI has assumed that an air stripper with a GAC polishing bed is required. The reasoning for this is not at all clear. The southern portion of the site does not require GAC polishing to meet ARARs or background levels. There are contaminants at the UPI site not found in the south area, but UPI has chosen to disregard any mention of these contaminants with the exception of MEK which they state will not be treated. The treatment train described will remove VOCs if designed properly (and will apparently reduce MEK levels to some degree), but an analysis should be undertaken addressing all the contaminants at the site, not just TCE.**

   Response: In CH2M Hill's comments dated March 23, 1989, comment No. 4 ..."The results for acetone and other organic compounds are not of as much interest because they are not major components of measured ground water contamination at UPI. The exception is MEK which was found at high concentrations at UMW-4." (See response to comments No. 5 and 6)

   It was because an analysis was performed which <u>did</u> address all the contaminants at the site, not just TCE, which lead to the need for GAC polishing following the air stripper. It is not practical to assume identical parameters between the northern and southern portions of the site.

8. **The text describes the air stripper as a "three-stage system." the meaning of this is not clear. The text also fails to address the effect that high TDS levels may have on the operation of the air stripper and the polishing bed. The text includes no explanation of the fact that TCE levels used for design purposes are above the solubility limit nor of the effect this will have on the treatment train. If free product is present, then separation may be appropriate prior to the air stripper.**

Lastly, the text states that the vapor phase carbon is regenerated offsite. If the investment in regeneration facilities is to be made, then why not regenerate all the carbon onsite?

Response:

- "Three stage system" should be interpreted as an air stripper system comprised of three air strippers in series. The text will be amended to this wording to avoid confusion.

- Please also refer to our response to the 3/23/89 CH2M Hill comments; comment number 23.

- A compound can be removed from the liquid feed to an air stripping unit only if it can move with the vapor phase under the operating condition with in the stripping unit. TDS are not capable of doing this and so the TDS concentration in the contaminated liquid phase will remain unchanged throughout the air stripping unit.

- For carbon adsorption to be most successful, the target molecule should be relatively small and insoluble in water. TDS are large relative to the carbon pore spaces in which carbon adsorption occurs and, by definition, they are soluble in water. Neither listed criteria for successful carbon adsorption is met and, as with air stripping, TDS concentrations are unaffected.

- We agree with CH2M Hill's concern as regards the potentially adverse effect that high TDS levels may have on the operation of the air stripper and polishing bed. The Langelier Stability Index (LSI) for Subunit A is positive indicating the potential for scaling is very real. Further calculations indicate that the use of a scale inhibitor such as sodium hexametaphosphate, or Flocon 100, does not reduce the potential for scaling appreciably.

- A cost for water pretreatment was included in the O&M cost estimates.

- The solubility of TCE in water is 1,100,000 ppb or 1,100 ppm (The Hazardous Waste Consultant, November/December 1986). The units used in the text to express TCE concentration levels are ppb. The design concentrations are:

  - GW-A.1: 14,100 ppb TCE maximum
  - GW-A.2: 34,000 ppb TCE maximum
  - GW-A.3: 14 ppb TCE maximum
  - GW-A.4: 5 ppb TCE maximum

  It is apparent from the above that the design maximum concentrations are three percent or less of the solubility limit. It is likely that the text reader/comment writer misread the concentration units in the text.

In conclusion, the TCE design concentrations are well below the solubility limits, thus explaining why free product separation of the groundwater treatment plant influent was not discussed. Free product separation would, in any case, be difficult to achieve at the pumping rates used in this scenario, or EPA's preferred remedy.

- o The text states that the vapor phase carbon system will be equipped with a steam regeneration system to be operated on-site.

- o The regeneration system operation is described in the following: Periodically the vapor phase carbon will be regenerated with steam. The steam will be introduced into the carbon bed and carry away adsorbed solvents from the carbon.

  Once outside the vapor phase carbon bed, cool water is passed over the steam piping. This condenses the steam and solvents into a liquid phase called condensate. A special condensate collection tank holds the condensate.

  If the concentration of solvents in the condensate collection tank is greater than the solubility limit, the solvents will coalesce in a liquid organic phase product. Special baffles in the condensate collection tank allow the liquid organic phase and the aqueous phases to be removed from the tank independently. The liquid organic phase will be removed periodically and transported off-site for incineration.

  Vapor phase carbon regeneration and waste streams in summary:

  Vapor phase carbon - Regenerated on-site
  Condensed steam - Process through air stripper
  Condensed liquid organic phase - Incinerated off-site

- o Liquid phase GAC system carbon cannot be regenerated by the regeneration system installed for the vapor phase carbon system. Liquid phase GAC carbon must be incinerated and properly processed to reactivate the carbon granules. There is only one U.S. facility permitted to incinerated and reactivate spent liquid phase GAC system carbon. The facility is off-site in Pittsburgh, Pennsylvania and liquid phase GAC carbon would be transported to the facility.

9. **The soils analysis also leaves some unanswered questions. It fails to address the relative effectiveness of SVE on the full range of contaminants at the site. In contrast to the main text which prominently mentioned the placement of a cap as an enhancement for the SVE system, the need for the cap has been deleted here with no explanation.**

   Response:

   - o In the comments on the March, 1989 RI/FS as provided by CH2M Hill, specifically comment number 26 on the FS, the statement was made that "The pilot test also indicated that a cap may not be necessary".

This comment by CH2M Hill was noted and used to prepare the June, 1989 supplement.

- The relative effectiveness of SVE for removal of a contaminant is dependent on the relative soil volatility. The concept of relative soil volatility is explained and the relative dry soil and wet soil volatilities for the range of volatile soil contaminants at the site is presented below:

  Soil volatility is dependent upon two phenomena: the compound's vapor pressure and the density of its vapor relative to air (its buoyancy). The soil volatility property does not incorporate the compound's Henry's Law Constant. Assumptions as to treatability by SVE are dependent on relative soil volatility and are completely removed from assumptions as to treatability by air stripping. Prejudices developed about certain compounds because of their inability to be removed by air stripping must be avoided when analyzing the effectiveness of soil vapor extraction.

  A compound's relative soil volatility is proportional to its vapor pressure and inversely proportional to a root of its molecular weight (The Hazardous Waste Consultant, November/December, 1986). The relative soil volatilities for all VOCs detected during Stage I and Phase II soils testing except ethylbenzene are listed below.

	Relative Volatility	
	Dry Soil	Wet Soil
1,1,1-Trichloroethane	33.9	10.1
Trichloroethylene	21.5	6.3
Xylene(s)	0.99-2.05	0.27-0.31
Acetone	72.5	26.3
Methyl Ethyl Ketone	30.5	10.6

(Hazardous Waste Consultant)

  It is apparent that all compounds are treatable with SVE where the soil volatility property is used to remove the contaminant from the soil. Although the values for xylene appear low they are still in the moderate range of effectiveness.

- The operation of an SVE system is expected to dry the soil within the radius of influence, particularly in a desert climate. The operation of the system will induce the affected area to exhibit the greater dry soil volatilities.

  Some theorists would entertain that the contaminant would be air stripped from a water phase on the surface of the soil particles. This would have the effect of limiting the rate of removal for some compounds. The drying action of the SVE system operation would remove this phase.

- The decision as to whether to place a cap over the Target Areas is considered a design detail to be addressed during final design if this alternative is implemented.

10. **The location of the soil contamination seems optimistic in light of the sparse soil data collected to rely on one well at each source area as sufficient for remedial purposes. While it is true that the radius of influence was extended to distances of 150 feet during the pilot test, the effectiveness of the well at those distances is much reduced due to dissipation of the air flow at that distance. With this combination of sparse soil data and unpredictable SVE performance, it would be prudent to install additional wells and overlap their radius of influence rather than assume that one well will be sufficient. The analysis also seems to have ignored the need for some method of evaluating the SVE radius of influence and the need for evaluation of soil concentrations following installation and operation of the system. Installation of soil gas monitoring wells would be appropriate.**

Response:

- Regarding the comment on the optimism suggested by designing the soil alternatives on "sparse soil data", Mr. Rosenbloom required the analysis be conducted to the degree prescribed regardless of the lack of data for basis.

- In the PGA SVE Pilot Study, 99% of the air removed from the uncapped site extraction well was removed from within 200 feet of the extraction well (Appendix S, p. 131).

- Each SVE extraction well has been located at the center of the highest maximum predicted mean TCE concentration in the vadose zone (Figure 1.6). The SVE extraction well will be most effective in these locations, exerting the greatest vacuum nearer the well.

- In the comments on the March, 1989 version of the RI/;FS, Unidynamics was criticized for using a 75-foot radius of influence; inferring that the 75-foot radius was too conservative. This comment made further reference to the SVE pilot test at the southern end of the PGA site and inferred that a 150-foot radius of influence was perhaps more appropriate. The comment was noted and used to prepare the June supplement. (See Comments on the March, 1989 RI/FS by CH2M Hill; comment number 26. Page 5-10, Section 5.2.2.1).

  The air inlet wells will be used to evaluate the SVE radius of influence. A field determination will be made as to whether a 150-foot or greater radius of influence has been attained.

- A method to evaluate the effectiveness of the SVE system is dependent upon the soil cleanup standards. The PGA soils sub-committee is still evaluating soils cleanup standards. It is not possible to design a system to evaluate cleanup effectiveness until the cleanup standards have been defined. This is a design detail that will be addressed in the final design task if this alternative is implemented.

SPECIFIC COMMENTS

Page 2S-1--Bullets: The area in the vadose zone that contains 99 percent of VOC contamination should be a target area.

Response:

- The basis for identifying target areas was specified in a letter from Hugh Barroll (EPA) to M. Corash dated May 10, 1989.
- The area in the vadose zone that contains 99 percent of the VOC contamination was never mentioned as a criterion in the letter or in subsequent directions from EPA.

Page 2S-2--Top of Page: The conversion of ug/l TCE soil gas to ug/kg TCE in soil is based on assumed porosity and bulk density values. To make absolute conversions with assumed values for soil properties is incorrect.

Response:

- Commentator must be referring to 'Page 2S-4--Last Paragraph', where the conversion is discussed.
- The conversion was requested by Jeff Rosenbloom of the EPA.

Page 2S-B--Last Paragraph-Interpretation: Other VOCs are present in the soils at UPI, including MEK, TCA, xylenes, ethyl benzene, toluene, and acetone. Of these compounds, MEK and acetone may be difficult to extract with SVE. The presence of compounds listed are generally associated with the occurrence of TCE, except for the borings in the vicinity of Waste Facilities 7 and 11, the drum storage area, and boring SCD. The interpretation and discussion does not address the other VOCs present in the soil.

Response:

- The commentator must be referring to Page 2S-3.
- The analysis does not address the other VOCs in the soil. However, it is apparent from the response to Comment 9 that the other VOCs will be amenable to treatment.
- We did not see toluene listed on Tables 2.7 or 2.8 of the RI summarizing detected VOCs during Stage I or Phase II programs. Xylene is listed.

It is not clear what is meant by ... "The interpretation and discussion does not address the other VOCs present in the soil". Finally, the PGA Committee has yet to determine the answer to two basic issues which are relevant here:

1. What is an acceptable level of cleanup of the soil; and

2. What method of monitoring to determine achievement of that level is appropriate.

Page 2S-18--First Paragraph: Excavation and treatment could be retained for localized areas where MEK and acetone are present.

Response:

This comment provides no guidance as to why retention of excavation is needed. Absent the pending results from the PGA soils committee there is no evidence that any localized areas are of concern. (Also see response to Page 2S-B.)

- All VOCs will be removable by SVE system operation and excavation and treatment is not deemed necessary.

- A compound's relative soil volatility is proportional to its vapor pressure and inversely proportional to a root of its molecular weight (The Hazardous Waste Consultant, November/December 1986). The relative soil volatility property does not incorporate the solubility of the compound as liquid phase mass transfer coefficients do. Thus SVE could be expected to remove all volatile compounds regardless of their ability to be removed from a liquid phase.

  Indeed, ketones have relative soil volatilities greater than TCE. Relative dry soil volatilities at 77°F are listed as: 21.5 for TCE, 30.5 for MEK and 72.5 for acetone. Relative wet soil volatilities are listed as: 6.3 for TCE, 10.6 for MEK and 26.3 for acetone.

  Three options for treatment of excavated soils are listed in the Feasibility Study (summarized in Chapter 5, Table 4.3). Each of these options are further evaluated on the basis of their effectiveness in meeting contaminant reduction goals while protecting human health and the environment, implementability in terms of securing required governmental approval and the ability of disposal or equipment services to treat the contamination and, finally, cost. The results of this evaluation process is found in Chapter 5, Table 4.7 of the Feasibility Study.

Page 2S-18--3.1 Soil Excavation: **If additional sampling is performed to evaluate the areal extent of VOCs that are not easily removed by SVE, excavation may become a viable alternative.**

Response:

(Also see response to Page 2S-B.)

- See response to preceding comment; acetone and MEK would be removed by SVE.

- o When soil cleanup standards are determined then additional sampling may be required.

- o Excavation is not a viable alternative for the UPI site.

Page 2S-22--Last Paragraph: **SVE well construction, particularly depth, is best determined on site.**

Response: The SVE well design presented should be considered preliminary and is based upon the SVE pilot study at the former GAC facility. Final design, if this alternative is determined necessary, will account for site geology and contamination at the boring location.

Page 2S-24--Second and Last Paragraph: **If excavation and SVE would be difficult to implement, why doesn't UPI propose another alternative?**

Response: It has been Unidynamics Phoenix, Inc.'s position that no action is required. The soil "contamination" does not represent a health and safety risk nor a threat to groundwater. Any invasive technology would be difficult to implement in Target Areas B and C because of ongoing manufacturing activities and safety requirements. It is the invasive nature of any soil contamination collection option that renders it difficult to implement within this area. The only non-invasive soil option consistent with protection of the environment is S-0: No Action.

Page 2S-27--Table A-1: **A breakdown of O&M costs presented in a table would be appropriate.**

Response: Comment noted. A breakdown of O&M costs will be included in the cost estimate listings on pages 2S-28 and 2S-29.

Page 2S-29--Target Areas B & C: **Since SVE in Areas B & C will be difficult to implement (page 25-24), where are these extra costs mentioned?**

Response: The difficulty in implementing SVE in these areas is the disruption of ongoing manufacturing activities in the area. Final design review may reveal specific equipment requirements or dictate relocating equipment due to the nearby manufacture of explosive materials. Increased costs would be estimated at that time.

The Goodyear Tire & Rubber Company

Akron, Ohio 44316-0001

July 6, 1989

VIA FEDERAL EXPRESS

Jeff Rosenbloom
Remedial Project Manager
U.S. Environmental Protection Agency
Region IX
215 Fremont Street
(T-4-2)
San Francisco, California 94105

Re: Phoenix-Goodyear Airport Superfund Site:
Comments of Goodyear on the RI/FS

Dear Mr. Rosenbloom:

This letter sets forth the comments of The Goodyear Tire & Rubber Company ("Goodyear") on the Environmental Protection Agency's ("EPA" or "the Agency") June 7, 1989, Public Comment Draft Final Remedial Investigation/Feasibility Study ("RI/FS") for the Phoenix-Goodyear Airport ("PGA") Superfund Site. The Agency originally stated that the comment period closes July 7, 1989, but as indicated below, we understand that this period will remain open to address additional information not yet contained in the Public Comment Draft RI/FS.

At the outset, Goodyear would like to note for the record that it entered into a Consent Decree with the Agency [dated October 24, 1988] to undertake source control measures for a portion of the shallow groundwater (referred to as Subunit "A") that underlies the PGA site where the highest concentrations of trichloroethylene ("TCE") and other volatile organic compounds ("VOCS") have been found. The Department of Defense, acting through the U.S. Army Corps of Engineers, Omaha District, also is participating in this source control measure. While Goodyear continues to adhere to the schedule in the Consent Decree for the performance of this work, several unanticipated field conditions have been encountered that have required adjustments to this schedule. Goodyear believes that its experience in implementation of this operable unit has provided extensive further information on the physical conditions at this site. It

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also has served to recognize the need to implement a remedy of this type with a reasonable degree of flexibility in order to adjust to varying site conditions that might occur during remedy implementation. Goodyear requests that all reports, data, correspondence and other related material transmitted to EPA during the implementation of this operable unit be included in the record for this final remedy.

The Public Comment Draft RI/FS contains an Endangerment Assessment for the PGA site that concludes that there is minimal risk to humans of exposure of TCE and other chemicals at this site because (1) the contaminated groundwater in Subunit A is currently not being used for drinking water; and (2) the drinking water for the Cities of Goodyear and Avondale currently meets all federal and state standards. Goodyear concurs with this assessment and recognizes that the proposed plan of action envisioned by this final remedy is intended to prevent the migration of potential future contamination into that groundwater that might provide a future source of drinking water if these areas expand. Thus, it is Goodyear's position that there is no imminent and substantial endangerment at this site.

Goodyear wishes to note for the record that the June 7, 1989, Public Comment Draft RI/FS did not contain the State of Arizona's groundwater model nor a final version of the vadose-zone transport calculations. The State of Arizona groundwater model was not received by Goodyear until late May, and the refined vadose-zone transport calculations were not received until June 23, 1989. As a result, Goodyear has not been able to fully evaluate the RI/FS within the three-month period otherwise allotted by EPA for comment. Therefore, the comments provided here are preliminary in nature and refer only to the June 7, 1989, RI/FS. Goodyear specifically reserves its right to comment on the State of Arizona's groundwater model and the vadose-zone transport calculations and will do so within three weeks of receipt of this information.

In addition, Goodyear has failed to receive other supporting data for the RI/FS from the Agency. In particular, EPA has not yet developed the detailed cost estimates for the various proposed alternative remedies. Technical discussions concerning the probable mass of TCE in the soil and the procedures for determining the specific area for cleanup and the termination point for cleanup are not even scheduled to occur with the Agency until July 7, 1989, the date the original comment period officially closes. Thus, Goodyear will not be in a position to respond to these aspects of the RI/FS until two or three weeks following receipt of the missing information and discussions with the Agency. Goodyear also specifically reserves the right to comment on these aspects of the RI/FS.

It is Goodyear's position that the failure of the Public Comment Draft RI/FS to incorporate complete supporting documentation has effectively denied Goodyear its right to comment on the proposed RI/FS in accordance with Section 113(k)(2)(B) of the Comprehensive Environmental Response, Compensation and Liability Act, as amended ("CERCLA"). CERCLA Section 113(k)(2)(B) provides that affected persons must have a "reasonable opportunity to comment and provide information" on the RI/FS. Judicial review of the selected remedy at a site is limited to the administrative record, CERCLA Section 113(j)(1). Thus, absent the ability to exercise its right to comment on the RI/FS in accordance with CERCLA, Goodyear is denied the right to adequately participate in the development of the administrative record: i.e., the only record that can be relied upon in any subsequent challenge to the selected remedy.

In the monthly technical meetings with Goodyear personnel and its consultant, Kaiser Engineers, Inc. ("Kaiser"), EPA has stated that the comment period will be extended beyond July 7th for a reasonable period of time to allow Goodyear to review and comment on any missing material. If the missing data are not in a form that would permit comment by Goodyear in the near future, Goodyear strongly suggests that EPA extend its September 30, 1989, deadline for issuing the Record of Decision ("ROD") for this site. While Goodyear realizes that the Agency has scheduled the issuance of the ROD to correspond with the end of its fiscal year planned accomplishments, a ROD cannot be issued if interested parties have not had an adequate opportunity to fully comment on the proposed remedy and based on the information in the administrative record, the proposed remedy is not cost-effective.

The following discussion outlines Goodyear's general comments on the June 7, 1989, RI/FS. Detailed technical comments are presented in an attached Appendix. See Attachment A.

TCE Residuals in Soils

To remedy soil contamination, the Public Comment Draft Final RI/FS offers two alternatives: using an asphalt concrete cap and soil vapor extraction ("SVE"). EPA has estimated that 115,000 pounds of TCE are present in the soil. For several reasons Goodyear's consultant, Kaiser, believes that EPA has overestimated the amount of TCE residuals in the soils. First, the soil vapor surveys put the soil column under vacuum, which leads to higher TCE vapor concentration to soil concentration ratios. Second, the conversion from soil vapor to equivalent total concentrations erroneously assumes the existence of saturated conditions with an equilibrium falling between the soil

sorbed state and dissolved state and dissolved state and vaporized state. Conditions allowing such conversion simply do not exist at the PGA site.

The conversion also assumes a single discrete value for the soil-water partition co-efficient based on an organic fraction in soil of 0.5%. Much of the matter in the soil column, however, is likely to be sand and gravel with little organic content. The ADWR model has assumed no retardation (Kd=0) for the aquifer. As the Kd approaches 0.0, the ratio of soil sorbed TCE to soil vapor TCE approaches 0.0. Thus, estimates of TCE residuals in the soil would be much smaller if the Kd equals 0.0 as estimated by ADWR.

Kaiser believes that a more accurate estimate of TCE residuals would be between 20,000 to 30,000 pounds; of which 1,000 to 5,000 pounds would be sorbed onto the soil particles or contained in interstitial water and between 15,000 to 29,000 pounds present as vapor in the pore space in the soil.

Because EPA has overestimated the amount of TCE in the soil and because no federal or state standards for the cleanup of soil contaminated with VOC's exist, Goodyear advocates the adoption of specific methods and criteria to address the field conditions as they are encountered during the cleanup process itself. This approach will require a consensus on acceptable cleanup levels based on more realistic estimates of soil contamination. To further emphasize this concern, Goodyear notes that if EPA proceeds with its current soil-vapor extraction rate, this remedy, as presently conceived, may produce the undesired outcome of extracting TCE up from the groundwater through the soil.

Because of the uncertainty over the actual mass of residual TCE in the soil and the operable migration pathways, Goodyear recommends a "decision tree" for determining when TCE soil evacuation can be terminated. See attachment B. While Goodyear understands that EPA has agreed to this approach in concept at various technical meetings, the parties have not yet agreed on the actual criteria levels that would result in terminating the soil extraction process at a certain point or the target area for cleanup. A meeting to discuss these various target cleanup levels has been scheduled for July 7, 1989. If this meeting achieves any consensus on the decision-tree approach, Goodyear reserves the right to comment on the target cleanup levels established for the decision tree. Until these target cleanup levels are established, neither EPA nor Goodyear can estimate the potential costs involved with the soil evacuation remedy or, more specifically, whether soil extraction is a more cost effective remedy than capping.

Groundwater

The Public Comment Draft RI/FS offers four alternatives to address the remaining groundwater contamination at the site: (1) pumping and treating at an accelerated rate using existing wells to meet existing standards; (2) pumping and treating at an accelerated rate using new wells to meet existing standards; (3) pumping and treating at an average rate using new wells to exceed existing standards; and (4) pumping and treating at an accelerated rate to exceed existing standards.

At the outset, Goodyear notes that the existing maximum concentration level ("MCL") under the Safe Drinking Water Act for TCE is 5 parts per billion (ppb). As the Agency's risk range for Superfund remedies is 10^{-4} to 10^{-7} and as the proposed revisions to the National Contingency Plan ("NCP") no longer require consideration of alternatives that exceed standards (53 Fed. Reg. 51506, December 21, 1988), Goodyear believes that alternatives 3 and 4 would exceed the requirements of CERCLA, and would not be cost effective.

Alternatives 1 and 2 both focus on meeting existing standards, but require pumping at an accelerated rate. Goodyear believes, for reasons discussed in greater detail below that the preferred alternative from a cost effective perspective should be one that pumps the contaminated groundwater at an average rate using existing wells.

EPA's discussion of groundwater in the RI/FS is flawed in several respects. Principally, EPA's final remedy has failed to take into account how contamination in Aquifers B and C will be eliminated by the operation of the interim remedy in Aquifer A. Second, EPA has failed to establish this pumping rate using any valid groundwater model. Indeed, it appears that the Agency has failed to use any existing groundwater contamination model, such as the ADWR model, at all. To our knowledge, no work is scheduled to refine the ADWR conclusions. Because the Agency has failed to use the ADWR model (or for that matter any valid model), the current RI/FS discussion of groundwater contamination is completely inadequate as a basis for selecting a remedy. Consequently, it has been virtually impossible for Goodyear to evaluate the selected alternatives. Goodyear urges EPA to recalculate the groundwater scenario using the ADWR model and specifically reserves its rights to comment on EPA's revised groundwater discussion. Finally, recognizing that federal standards for TCE exist, Goodyear believes there should be a process to terminate pumping and treating groundwater after certain action levels are met.

Although EPA apparently favors air stripping over carbon treatment as part of this overall final remedy, Goodyear nevertheless desires to emphasize the efficacy of air stripping. As EPA is aware, Goodyear sought modification of the Consent Decree for that part of the operable unit addressing pumping and treating Subunit "A" because it felt that carbon treatment far exceeded the applicable, relevant and appropriate air quality standards for this area, and was consequently not a cost effective alternative. This position was based on a sophisticated risk assessment of area-wide air emissions that was performed by ICF Technology, Inc. Goodyear is including this risk assessment and a copy of its correspondence to EPA on this subject as part of these comments (Attachment C).

Finally, none of the groundwater alternatives currently envision that any of the treated groundwater would be used for any purpose other than reinjection. If other viable uses become apparent during the implementation of this remedy, Goodyear notes that water rights administered by the State of Arizona will have to be dealt with, and that a reasonable degree of flexibility should be factored into implementation of the final remedy to meet these potential requirements.

Conclusion

Goodyear and its consultant have reviewed the June 7, 1989, RI/FS for the PGA site and have found the document to be flawed in several major respects. Moreover, as the June 7, 1989, draft final RI/FS currently exists, it provides an inadequate basis for commenting on, or selecting, a cost-effective remedy for the PGA site. Goodyear would be happy to answer any questions that the Agency may have on these comments.

Sincerely,

David L Chapman
Manager
Environmental Engineering

David L Chapman
pah

Attachments

89187RDS0690

ATTACHMENT A

TECHNICAL COMMENTS

1. P 2-37. The discussion of metals in soil encompasses all metal data generated regardless of the probable source of the metal or background levels in the area of the PGA. This discussion is particularly misleading with respect to arsenic since natural arsenic levels are sufficiently high to generate risk levels of concern and there is no record of use of arsenic on site. The failure to segregate site-related contaminants from naturally occurring ones results in soil ingestion risks being driven by arsenic which cannot be remedied since it is ubiquitous in the native soil. A few statements to this effect would prevent the reader from being misled about site-related risks.

2. P 2-40. No attempt has been made to differentiate Cr(III) from Cr(VI) or leachable chromium from fixed or insoluble chromium. As a consequence, total chromium values are reported and used for the purposes of estimating public health impacts even though availability and valence state greatly effect the nature and magnitude of risks.

3. P 2-54. An estimate of the inventory of TCE in soil of 450 lbs was made from existing soil boring data. When an amount equal to this was removed during pilot soil evacuation work, a second estimate was attempted using soil vapor data. The latter estimate came to as much as 115,000 lbs depending on the assumptions made with respect to vertical distribution of TCE residuals. The algorithm used to calculate total soil TCE mass from soil vapor data relies on an assumed equilibrium condition between soil-sorbed TCE, water-bound TCE, and soil vapors.

   For simplification, a single partition value was used to calculate soil/water ratios. This value was also used in conjunction with the Henry's law constant to predict soil/vapor ratios. The partition value selected was based on a prescribed soil organic level. Use of any value other than 0.0 contradicts the assumptions made by the Arizona Department of Water Resources (ADWR) in preparing the ground water model for the site. While the ADWR assumption is probably overly conservative, an assumed constant value throughout a 60 foot depth is also misleading. It is highly likely that deep sands and gravels will have little or no affinity for the TCE. Hence, use of the algorithm will overpredict soil-bound TCE from the existing TCE vapor data.

The likelihood of overprediction is illustrated by analysis of the existing data. The highest soil vapor values were found in the area of the soccer field. Borings in that same area revealed no measurable TCE in subsoils. Hence, the algorithm is assigning TCE at significant concentrations to soils that have no evidence of contamination. Similarly, soil vapor readings from the area of the Phillips well were as high as 1.7 ug/L even through this property is 3 miles from the site. These vapor levels are either derived from other sources or reflect the ground water plume at that point. There is no evidence that they are associated with soil contamination.

4. P 2-61. Calculations are made to estimate the total volume of soil in excess of Arizona Department of Health Services (ADHS) soil action levels. These volumes are meant for use in determining the cost of remedial action. The volumes are misleading, however, since they encompass all soils and subsoils with VOC concentrations in excess of the action level. The action level was devised for surface soils, not deep subsoils. Most TCE residuals lay 20 to 30 feet below the surface. Alternate action levels are needed for these soils on the basis of their ability to affect ground water quality.

5. P 2-61. Vadose zone calculations are made suggesting that 16,000 lbs of TCE will move to the ground water in 20 years. These calculations are based on an assumed recharge that is without documentation. They also appear to take no recognition of unsaturated zone transport times. Using EPA time-of-travel algorithms, recharge at 0.32 in/yr would take 117 years to move 20 feet downwind under current conditions. If the TCE has a partition coefficient of 0.49 L/Kg, its travel time would be retarded by a factor of 2.6 and hence would be 304 years.

6. P 3-46. The risk calculations are based on current TCE concentrations at various wells around the PGA site. No attempt was made to use the ADWR model to see how those concentrations will change over time. Since cancer risks are based on 70 years of exposure, the assumption is tantamount to saying that the ground water at any one well will not see any appreciable change in TCE concentrations over a 70 year period. That is unrealistic. Simple application of plume size and the estimated velocities in the affected aquifier suggest the concentrations will drop an order-of-magnitude in seven years. If that does occur, the actual risk at the site will be one tenth that predicted in the RI/FS. The analysis also fails to consider the affects of the Operable Unit 16 remedy which is currently under construction.

7. P 3-46. Well logs from construction of extraction and injection wells for the Operable Unit 16 remedy suggest that the boundaries between subunits A, B and C are not always distinct and then in some areas, the units may be indistinguishable. Previous descriptions imply rather clear cut interfaces which is misleading.

8. P 4-1. Risk estimates for suspended particulate are based on current emission rates being sustained over a 70 year period. A simple calculation shows that in a period of 7 years, the finer suspendable particles will be depleted to a depth of 1.5 cm. This in effect will leave the larger, nonsuspendable particles to armor the surface and minimize further resuspension. As a consequence, risks will actually be an order-of-magnitude less than predicted. The bulk of the risk from suspended particles is attributable to arsenic in the soil. Since arsenic is naturally present and not a site-related contaminant, the risk calculations provide a misleading picture of incremental risk and risks that can be addressed by a site remedy. All soils in the area pose the same level of arsenic driven risk.

9. P 5-41. The ultraviolet-ozone oxidation process is dismissed prematurely. Recent studies show this process to be very effective in removing organic contaminants from water. In areas where air stripper emissions must be treated with carbon, the UV-ozone process can be cost competitive.

10. P 6-13. Target Area 1 is inappropriate. ADHS action levels were designed to address surface soils, not subsoils 20 to 30 feet beneath the surface. IF a target area is to be defined using ADHS action levels, it should be based solely on TCE concentrations in surface soils.

    Target Area 3 is not based on any defensible rationale. No attempt is make to relate soil vapor concentrations to site risk values. Since soil vapor results do not correspond with subsoil concentrations of TCE, the use of soil vapor to delineate a target area is illogical. At a minimum soil vapor values should be converted to equivalent soil concentrations and the target area defined on the basis of the latter.

11. P 6-21. The discussion of the capping alternative appears to contradict other portions of the RI/FS. The implication of this discussion is that recharge is insignificant with respect to TCE movement. And yet, the calculations of vadose zone movement and soil residual effects on ground water quality are based on a prescribed recharge rate of 0.32 in/year. Either recharge is driving TCE downward and capping will minimize or prevent this migration, or recharge is insignificant and sub-soil contamination can be left in place without remedy.

12. P 8-2. A very simplistic analysis is employed to calculate aquifer flushing times. This is difficult to explain since a great deal of money has been spent developing a sophisticated ground water model to predict flushing times and plume movement. The RI/FS should rely on model results for flow and transport predictions.

13. Figure 8-3. The contaminant plumes have been depicted as large areas joining points wherever VOCs were detected in ground water without regard to the relative concentrations at adjoining wells. Geostatistical analysis should be used to prepare these plots. The relatively high values at the Phillips well and lower concentrations at points between Phillips and the site open the possibility of multiple sources or a more concentrated transient plume that is passing by Phillips to be followed by water of better quality. Since risk was estimated on the basis of continued exposure to current levels, a better characterization of the actual plume could have a big impact on conclusions concerning risk and the nature of required remedies.

14. P 8-30. Simple equations are applied to estimate ground water travel times. The ADWR model was developed to provide much more accurate predictions of travel times and should be employed for that purpose.

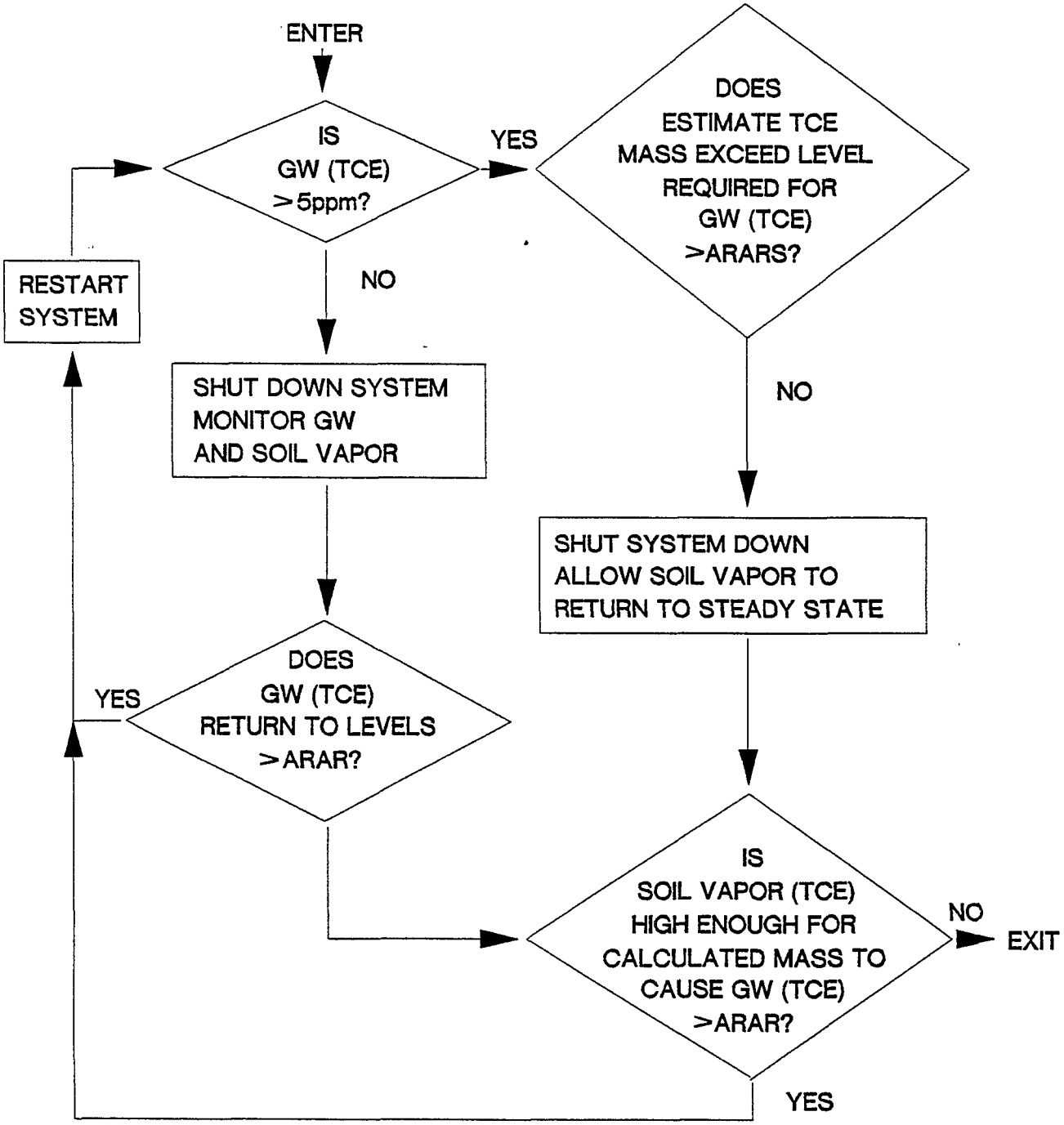
15. P 8-36. A simplified approach is taken to calculate the time required to achieve clean up. Once again, the ADWR model should be employed for this purpose. Furthermore, the estimates do not consider implementation of the Operable Unit 16 remedy or continued inputs from the vadose zone. This static evaluation of aquifer cleansing is unrealistic.

16. P 9-7. The analysis of end use options for the treated ground water does not give ample consideration to problems associated with water rights. A brief discussion is given of water rights after discharge. However, it is not clear if the water is currently owned by a party who can subsequently dictate where the treated water should go. If the City of Phoenix or some similar entity owns the ground water, they may not allow it to be delivered for private or public use by other entities. A much more thorough evaluation of ownership is required before discharge alternatives can be considered.

17. P 10-1. The options for design of the ground water extraction system should be evaluated using the available models of the local ground water. A simple water balance approach fails to consider the Operable Unit 16 remedy and the complexities of the aquifer. With sophisticated tools readily available to support the analysis, reliance on simple approaches is indefensible.

ATTACHMENT B

SOIL EVACUATION TERMINATION LOGIC FLOW



ATTACHMENT C

file = PGA Site, AZ

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(202) 429-2726

December 7, 1988

Jerry Clifford
Assistant Director of Superfund
Region 9
U.S. Environmental Protection Agency
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Dear Mr. Clifford:

Goodyear appreciated the opportunity to meet with you, your staff and representatives of Region IX's Air Programs on November 30, 1988, to review the current project at the Litchfield PGA site and to discuss the extent to which carbon treatment should be required as part of the operation of the first seven extraction wells associated with this operable unit. The dialogue was informative and constructive, and this letter follows-up on those discussions with a specific proposal.

As we indicated in that meeting, Goodyear requests, pursuant to Paragraph XXV. of the Consent Decree that was entered on October 31, 1988, that a modification to Paragraph VII.C.5.(c) of the Consent Decree be considered by EPA. This request is based on information that was not available during the time in which the Consent Decree was negotiated. It was discussed at our meeting and is being formally presented to you by this letter.

Goodyear recommends, as a result of this new information (which is discussed in greater detail below) that any requirements for carbon treatment that may exist in the current Consent Decree be formally eliminated. In the alternative, Goodyear requests that the issue of carbon treatment be deferred for at least two years, until the final remedy has been selected and designed. As we indicated at the November 30, 1988, time is very much of the essence with respect to this request for modification as Goodyear is required, pursuant to Paragraph VII.D.5. of the Consent Decree, to submit a proposed final design to EPA by January 11, 1989. This issue relates significantly to how that design will be developed and presented.

As you are aware, Goodyear prepared a set of comments relating, among other things, to this issue which was submitted to the Department of the Justice ("DOJ") for consideration during the period of time in which the Consent Decree had been lodged and made available for public comment. Regretably, these comments were not considered before the Consent Decree was signed and filed on October 31, 1988. However, we are incorporating these comments as an enclosure to this letter (Enclosure 1), as they address Goodyear's position concerning the applicability of Arizona State requirements to the issue.

In this letter, we cited a number of EPA documents ("Guidance on Feasibility Studies under CERCLA" dated April, 1985, page B-19 and the "Superfund Public Health Evaluation Manual" dated October, 1986) to observe that the risk range of 10^{-4} to 10^{-7} is used by EPA to determine adequate protection of public health and the environment when there are no national standards that otherwise would establish an appropriate level of cleanup. We also note that this risk range has been presented by EPA for comment in its proposal for inclusion in revisions to the National Contingency Plan which were announced on November 17, 1988; but EPA also has requested comments on reducing this risk range from 10^{-4} to 10^{-7} to a range of 10^{-4} to 10^{-6}. We indicated in our October 19, 1988, letter to DOJ that "the health risk of exposure to the air emissions from the air strippers, without carbon absorption, is no worse than 10^{-4}, and also stated that Goodyear would be developing additional data to support this position which would be forwarded to you under separate cover. This data was discussed with you on November 30, 1988, and is incorporated into this letter as Enclosure 2.

Goodyear's consultant, ICF, Inc., performed a risk assessment of the release of volatile organic compounds ("VOCs") into the air with air stripping but without carbon absorption. Taking trichloroethylene ("TCE") alone, the cancer

risk is less than 1×10^{-7}. Indeed, at 100 meters from the extraction wells, the cancer risk is $.74 \times 10^{-7}$, and then diminishes significantly as one proceeds away from the site at 300 meter, 700 meter and 1500 meter increments. When one incorporates the cancer risk of dichloroethene (DCE) into the equation, the combined risk for both substances is less than 10^{-6} (actually, $.24 \times 10^{-6}$ at 100 meters).

As we indicated in our meeting, the fundamental objective of Superfund cleanups is to adequately protect public health and the environment. While we recognize that a great deal of discretion exists within EPA in determining what is adequate protection, and that this discretion is in large part bolstered by somewhat conflicting criteria within the Superfund Amendments and Reauthorization Act ("SARA") (which EPA describes in the preamble to the proposed revisions of the NCP as a "dynamic process,") we submit that the fundamental objective should be adequate protection of public health in the most cost effective manner. EPA guidance and proposed revisions to the NCP subsequent to enactment of SARA have provided various bases for determining what is adequate protection of public health and the environment. First, EPA uses applicable, relevant and appropriate federal and state requirements ("ARARs"). While there are technology based standards relating to Arizona's State Implementation Plan ("SIP") for sources emitting TCE contaminants, Goodyear does not believe that they can be interpreted as requiring carbon absorption in the PGA case for the reasons discussed in greater detail in Enclosure 1. However, those standards are not health based; rather, they are technology based. As to health based standards which also are intended to address the adequacy of public health protection, we believe that we have demonstrated to you and your staff that air stripping from these extraction wells will more than adequately achieve that purpose without the need for carbon treatment.

During our meeting, mention was made of a developing policy within EPA concerning the requirements for Superfund remedies located in non-attainment areas. While Goodyear appreciates the issue and is very sympathetic to the air pollution problems that exist in certain areas of the country, including Phoenix, we can find no legal basis for the application of a non-existent (but emerging) EPA policy in this area. In addition, we question whether or not such a policy would fall within the cost-effective criteria of SARA, if it can be demonstrated that air emission controls are not required to adequately protect public health and the environment.

During our meeting, concern was also expressed as to whether remedies established at other Superfund sites within

the Phoenix, Arizona area would be brought into question if Goodyear were not required to install carbon absorption as part of the treatment of the extracted groundwater. We have examined the sites that were mentioned, and offer the following factors to distinguish each of them.

At the Indian Bend Wash Superfund site, we are informed that the City of Scottsdale is operating an air-stripping tower (at well no. 6) which is not equipped with emission control equipment. According to representatives of Arizona's Department of Environmental Quality and the City of Scottsdale, the City is allowed to operate this air stripper without emission control equipment because it emits less than 40 pounds of VOCs per day, which is the threshold level for emission controls under Maricopa County regulations. The City is planning five to six additional air-stripping towers where it does intend to install air emission control equipment. According to the City, however, the reason for installing air emission controls is due to the residential character of the area and the request by neighboring citizens for air emission control equipment, not because such controls would be required pursuant to any regulation. Also, we are informed that the City's future towers will be part of a final (as opposed to an interim) remedial plan.

Another federal Superfund site in Maricopa County, Motorola 52nd Street, currently is in the planning stage. The Draft Remedial Action Plan prepared by Dames & Moore (June 24, 1988), indicates that Motorola is considering use of carbon absorption emission controls in its air-stripping towers, although no firm decision has been made. Dames & Moore anticipates that the air-stripping towers will be located at Motorola's plant facility. Because the plant facility already is subject to air emission requirements, representatives of Dames & Moore believe carbon absorption may be necessary for the air-stripping towers to keep total plant air emissions below regulated levels. Motorola's plan appears to be in its early stage (10%) plan, and Dames & Moore indicates that plans to use carbon absorption may change as the design progresses.

EPA apparently has allowed other air-stripping towers to operate without emission controls in Pima County, Arizona so long as those facilities met applicable air quality regulations. We have been informed that the applicable regulation in Pima County requires emission controls at "miscellaneous" sources if VOC emission exceed 2.4 pounds per day. Representatives of the City of Tucson and Hughes Aircraft informed us of currently operating air-stripping towers at federal Superfund sites that emit below the 2.4 pounds requirement. Neither of these towers has been required to

install air emission controls, as VOC emissions did not exceed the regulatory threshold.

It is significant that emission controls have not been required for air stripping units at state-lead remedial action sites in Maricopa County where less than 40 pounds per day of VOCs are emitted. We provided you with the original of a printout obtained from the Maricopa County Health Department Bureau of Air Pollution Control. (A copy is attached for your convenience, Enclosure 3). The printout listed all stripper facilities with potential emissions of less than 40 pounds per day of volatile organic compounds which obtained air permits during the calendar years 1987 and 1988. Of the sixteen listed sites (eight of which emit VOCs at levels equaling or exceeding the maximum of 10 pounds per day expected from Goodyear's proposed facility), only one is equipped with air emission controls: an air stripper at a Texaco service station at 305 East Thomas Road. That cleanup is managed by W.W. Irwin, Inc., of Long Beach, California. Long Beach is located in California's South Coast air quality control district, which district requires such emission controls for any facility emitting over one pound of VOCs per day. W.W. Irwin has informed us that it simply did not investigate the applicable Maricopa County regulations and proceeded under the erroneous assumption that a one pound per day limit applied in Maricopa County. Such emission controls were neither required nor requested by Maricopa County's Bureau of Air Pollution Control.

Maricopa County does not maintain air monitors in or near the City of Goodyear or the Phoenix Goodyear Airport. It would be difficult unequivocally to claim that the area immediately surrounding the Phoenix Goodyear Airport would be in attainment for ozone, if a monitor were placed there. Because it is largely a farming area and the prevailing wind and weather patterns in the Phoenix area are from west to east (thus tending to carry ozone and other pollutants from the metropolitan area eastward), it would not be unreasonable to assume that Goodyear, which lies to the far west of Phoenix, would be in attainment with regard to ozone levels, were a monitor present at the airport.

In summary, this modification is based on the fact that we did not have a risk assessment of the air emissions that would occur without carbon absorption when we negotiated this Consent Decree. Indeed, many of the numbers that form the basis for this risk assessment were not developed until the completion of the conceptual design. We believe that this information clearly supports a view that, at a minimum, Goodyear should be given the opportunity to defer any requirements for carbon absorption until the overall requirements for treatment become better known in the final remedy.

As was stated at the meeting, we recognize that many of the requirements for this operable unit form the "cornerstone" of the final remedy. But, at the same time, as Section 121(d)(4)(A) of SARA indicates, ARARs and related requirements do not have to be considered as part of an interim remedy. Equally relevant in these considerations is the need to maintain a continuous and constructive relationship between EPA and Goodyear over a considerable number of years. The constructive relationship that we have sought to establish with EPA in working on this project is based on the elements of fairness and reasonableness that we believe now prevail, and will continue to prevail in the long term future in which both of us will be associated with this project. To request a potentially responsible party, such as Goodyear, to invest $300,000 - 500,000 in capital expenditures for carbon absorption at these first seven wells, as well as an estimated average of $90,000 per year for routine maintenance when adequate protection to public health and the environment already exist through air stripping based on EPA's existing criteria, simply does not seem right.

Goodyear hopes that you take this request for a modification in the spirit in which it is given. While we recognize that the request follows closely on the heels of the final Consent Decree, we would emphasize that the data to support it did not emerge until completion of the conceptual design, and that Goodyear has fulfilled every commitment in the Consent Decree since it undertook the initial work in April, 1988.

Thank you for your consideration of this request and we continue to look forward to working with Jeff Rosenbloom and other EPA staff in the future.

Sincerely yours,

William N. Hedeman, Jr.

WNH/b
Enclosures
cc: Alexis Strauss (with enclosures)
Jeff Rosenbloom (with enclosures)
Hugh Barroll (with enclosures)
Barry Sandals (with enclosures)
David Chapman (without enclosures)
Mark Phillips (without enclosures)
Takashi (Wally Ito) Ito (without enclosures)
John Hill, ICF (without enclosures)
Rolf R. von Oppenfeld, Fennemore Craig (without enclosures)

1081g

THE GOODYEAR TIRE & RUBBER COMPANY
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(216) 796-3084

October 19, 1988

COPY

Assistant Attorney General
Land & Natural Resources Division
Tenth and Constitution Avenue, N.W.
Ben Franklin Station
P.O. Box 7415
Washington, D.C. 20044-7415

Re: **United States v. The Goodyear Tire & Rubber Company; D.J. Ref. 90-11-2-186 Comments of The Goodyear Tire & Rubber Company on Proposed Consent Decree**

Gentlemen:

The Goodyear Tire & Rubber Company (hereinafter "Goodyear") hereby submits its comments on the referenced proposed Consent Decree addressing the operable unit remedial action at the Phoenix-Goodyear Airport Superfund site in Litchfield Park, Arizona.

Goodyear respectfully requests the Department of Justice ("DOJ"), after consultation with the Environmental Protection Agency ("EPA") to file these comments with the court along with a concurrent motion to enter a judgment that is consistent with modifications to the draft consent decree as presented below.

Before addressing the two areas of major concern to Goodyear in the proposed consent decree, Goodyear would like to make a preliminary observation. Goodyear responded to the EPA's notice letter concerning its willingness to enter into discussions with EPA concerning the negotiation of the proposed consent decree in a timely manner. However, the unique circumstances at this site, and in particular the involvement of the U.S. Navy as a potentially responsible party ("PRP") along with Goodyear, raised significant legal and policy issues that required resolution within the Department of Defense concurrently

with Goodyear's negotiations with EPA. Resolution of several of these issues occurred through an alternative dispute resolution ("ADR") process between Goodyear and the Department of Defense, represented by the U.S. Army Corps of Engineers, Omaha District, which did not conclude until May 21, 1988.

During this period of time from September 3, 1987 (the date on which the notice letter was sent to Goodyear) to May 21, 1988, (the date on which Goodyear signed the consent decree), Goodyear initiated the first phases of the work described in Paragraph VII of the consent decree, and has submitted all work elements required by Paragraph VII as if the consent decree were effective and binding. This was done to ensure that Goodyear's (and subsequently the Department of Defense's) commitment to address the problems at this site would not be unnecessarily delayed while waiting for full resolution of the exact provisions of the filed consent decree. However, as Goodyear proceeded into the conceptual design of this operable unit ("OU"), it became aware of other alternatives associated with conducting this interim remedy not known to all of us (EPA, Goodyear, and the Department of Defense) during the development of the operable unit feasibility study ("OUFS") that yielded EPA's Record of Decision ("ROD") on September 29, 1987.

We emphasize this point to indicate that the changes requested in the proposed consent decree that are outlined below are changes that have evolved during Goodyear's voluntary performance of the work elements displayed in Paragraph VII of the proposed consent decree. While we do not believe that any of these changes to the proposed consent decree would trigger, as a condition precedent, a change to the ROD, we do believe that the changes would further clarify the intent of all of the parties, would be consistent with the ROD and the requirements of the Comprehensive Environmental Response Liability and Compensation Act ("CERCLA"), as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), and also would provide adequate protection to public health and the environment in a cost effective manner.

A. <u>Disposal of Treated Water:</u>

Our first proposed change relates to Paragraph VII.C.5(a) of the proposed consent decree which reads as follows:

> All water from the groundwater extraction system will be treated and reinjected. Treatment shall assure that reinjected water will meet federal and state standards for treatment

> plant discharge levels prescribed in Table I of the 1987 ROD. During start-up activities, extracted water to and from the treatment plant will be checked on a schedule as provided for in the Operations and Maintenance Plan submitted in accordance with subparagraphs D.8 and D.10.

This subparagraph of the consent decree was written following the emphasis in the ROD that the only alternative for disposing of the water that was pumped and treated from Subunit A was to reinject the treated water back into the ground. This section, as written, would require reinjection of the water and would not permit consideration of other available beneficial uses of this groundwater.

Currently the natural background quality of Subunit A water addressed by the OU is located is so poor that it is not used for potable, agricultural, or industrial purposes. Tests show average total dissolved solid concentrations of approximately 3,000 ppm. The existence of industrial contaminants slightly further degrades the extracted water's quality. As presently written, the consent decree provides no option for cost-effectively treating the water to manage the background contaminants that remain after the water is treated to remove the industrial contaminants of concern. If these background contaminants can be economically managed, it could potentially create the availability of additional water resources for use in the Arizona desert.

The 1987 ROD incorporated the OUFS discussion of potential water disposal options. The OUFS indicated that disposal options other than reinjection are not economically feasible, although other uses may be desirable. Presently, the proposed treatment water reinjection system calls for installation of 15 to 18 reinjection wells along with a distribution piping system. The capital cost of this system will range from $500,000 to $1 million. There also will be a large operation and maintenance cost associated with the reinjection system. The operation of the reinjection system may pose substantial technical challenges which are of concern to Goodyear. Goodyear believes, therefore, that from a cost-effectiveness and technical viewpoint, an option to create an economically usable water resource from the extracted water may exist, or may arise at some point in the future. Goodyear further believes the potential for managing a presently non-usable water resource to create a viable water resource should be encouraged and further explored, if determined by Goodyear to be economically practicable. Of course, if such

an alternative proved to be feasible, it would have to be consistent with the water laws of the state of Arizona, and should be approved by the Arizona Department of Water Resources. Therefore, Goodyear respectfully requests DOJ and EPA to consider and support a modification to the consent decree to allow Section VII.C.5(a) to read as follows:

> All water from the groundwater extraction system will be treated. All treated water from Subunit "A" will be reinjected, or in the alternative, disposed of through an economically practicable and beneficial use on terms and conditions approved by the Arizona Department of Water Resources. Treatment shall assure that reinjected water will meet federal and state standards for treatment plant discharge levels prescribed in Table 1 of the 1987 ROD. All water disposed of through a beneficial use shall be treated or otherwise meet all applicable federal and state water quality standards and criteria.

B. Air Emissions from Air Strippers:

Goodyear's second issue relates to Section VII.C.5(c) of the proposed consent decree, which reads as follows:

> Air stripping will be used to reduce volatile organic compound ("VOC") contamination to meet federal and state standards as prescribed in Table 1 of the 1987 ROD. The air stripping towers will be equipped with air emission controls in order, among other purposes, to meet Maricopa County requirements, including Rule 32-C and any other applicable provisions of the Arizona implementation plan under the Clean Air Act. If the Maricopa County requirements are revised and approved by EPA pursuant to the Clean Air Act to specify that sources such as the air stripping towers are not subject to air emission controls, then Goodyear may petition EPA to agree to amend this consent decree to remove the air emission control requirement of this paragraph. Any dispute with regard

to any such petition shall be subject to dispute resolution in accordance with paragraph XXII.

Goodyear entered into negotiations with EPA and DOJ concerning the proposed consent decree guided by two principal documents: the provisions of CERCLA/SARA, including related guidance documents and the National Contingency Plan; and the requirements of the ROD.

1. ROD Requirements:

The ROD specifies that "the air stripping towers (related to the air stripping required to reduce the VOC contamination of the groundwater) will be equipped with air emission controls in order to meet Maricopa County requirements that all new air emissions sources employ reasonably achievable control technology to reduce emissions, as promulgated by the Superfund Amendment and Reauthorization Act (SARA). Remedies should significantly and permanently reduce the volume, toxicity and mobility of the contaminants."

During recent discussions with EPA, concerns have surfaced as to precisely what the requirements of the ROD are and whether or not the above-quoted provision in the proposed consent decree adequately reflects those requirements. Specifically, Goodyear was operating under the impression that Maricopa County Air Pollution Control ("MCAPC"), Rules and Regulations, Regulation III, Rule 32(C) requires application of emission control technology for new VOC emission sources under certain conditions. Through its consultant, Dr. Lial F. Tischler of Engineering-Science, Inc., Goodyear advised EPA by letter dated October 2, 1987, (after the date of the ROD and the notice letter) that it had conferred with Mr. Lawrence Crisafulli of the Maricopa County Air Pollution Control to determine how those regulations apply to VOC stripping columns used for groundwater treatment. That conference revealed that the primary condition that the MCAPC applies to determine if emission controls are required for a new source is a minimum emission rate of 40 pounds of VOC emissions per day. At an estimated maximum rate of 10 pounds of VOC emissions per day, the air stripping requirements for the Litchfield site are well below the de minimis level and should not require emission controls. A copy of this letter is included as Attachment 1.

Goodyear also has requested an opinion from Arizona counsel, Fennemore Craig, concerning the requirements for air stripping under the Arizona law and related implementation plan.

We are attaching to this letter a copy of that memorandum dated October 10, 1988, (Attachment 2) that basically concludes that Rule 32(C), which has now been renumbered as Rule 320 as a result of amendments to the Maricopa County Air Pollution Control Rules and Regulations on July 15, 1988, does not require carbon adsorption emission controls for the air stripping towers.

When Goodyear was involved in negotiating the proposed consent decree with EPA and DOJ, it was operating under the understanding that the limit in Maricopa County for the discharge of VOC contaminants from air stripping towers without carbon absorption is 40 pounds per day. It also was aware that there were considerable discussions between EPA and the state of Arizona concerning the amendment of the state's implementation plan, and that these requirements could be adjusted upward or downward. Although Goodyear had not yet retained a consultant to commence the conceptual design for this project or receive the benefit of the consultant's advice in this area, Goodyear nevertheless supported the language in Paragraph VII of the consent decree in order to recognize the opportunity to adjust the design, construction and operation of the OU if changes in the Arizona/Maricopa County requirements were to occur. As indicated by the Fennemore Craig memorandum, changes did occur on July 15, 1988, but these changes did not alter the general statement within the regulations that up to 40 pounds per day of VOC emissions are acceptable without carbon adsorption emission controls.

2. CERCLA/SARA Requirements:

Remedial action selected under SARA must attain a degree of cleanup of hazardous substances, pollutants or contaminants which include applicable, relevant and appropriate federal and state requirements (often referred to as "ARARS"). "Compliance [with these requirements] is required at the completion of the remedial action for hazardous substances, pollutants or contaminants that remain on site."[1] Thus, EPA's guidance emphasizes that these requirements must be achieved in the context of the final remedy, but not necessarily in the context of the interim remedy such as the OU envisioned for this site.

Further emphasis of this point exists in Section 121(d)(4) which specifies that EPA:

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[1] 52 Fed. Reg., page 32495, "Superfund Program; Interim Guidance on Compliance with Applicable or Relevant and Appropriate Requirements; Notice of Guidance, August 27, 1987."

> . . . may select a remedial action meeting the requirements of paragraph (1) [i.e., ARARS] that does not attain a level or standard of control at least equivalent to a legally applicable or relevant and appropriate standard, requirement, criteria, or limitation as required by paragraph (2) if [EPA] finds that -
>
> (A) The remedial action selected is only part of a total remedial action that will attain such level or standard of control when completed; . . .

While Goodyear has been unable to obtain any "official" interpretation by EPA of the criteria that it will consider with respect to this waiver, we have examined a recent draft guidance document entitled "CERCLA Compliance With Other Laws Manual" dated August 8, 1988 (OSWER Directive 9234.1-01). Paragraph 1.3 of that document, entitled CERCLA Waiver Criteria for ARARS, states as follows:

> This waiver may be applicable to interim measures that are expected to be followed within a reasonable time by complete measures that will attain ARARS. The interim measures waiver may apply to sites at which a final site remedy is divided into several smaller actions.
>
> * * *
>
> The factors that may be appropriate for invoking this waiver include:
>
> * * *
>
> - Non-interference with final remedy. The interim measures selected must not interfere with, preclude, or delay the final remedy, consistent with EPA's priorities for taking further action. (Emphasis added).

Goodyear believes that this guidance is "relevant" to the situation at hand. Specifically, in a reasonable period of time, Goodyear anticipates that EPA will complete the feasibility study for the final remedy at this site and issue a ROD that may,

inter alia, address the need for additional groundwater treatment and perhaps other related matters. Goodyear also believes that it should not embark on costly requirements to design an air stripper with carbon adsorption features if those features become redundant, or are inconsistent with the overall requirements of the final remedy. Thus, Goodyear maintains that the consent decree should be adjusted to clarify that air stripping towers do not have to be equipped with carbon adsorption devices for this interim remedy measure. As indicated in the Fennemore Craig memorandum, we have received concurrence with this approach from the Maricopa County officials (Attachment 3).

Section 121(b) of SARA requires EPA, in assessing alternative remedial actions, to take into account a number of criteria which include:

(1) the persistence, toxicity, and mobility of the hazardous substances;

(2) long term maintenance costs;

(3) the cost effectiveness of the remedy; and

(4) the ability of the remedy to adequately protect human health and the environment.

It could be argued that regardless of state requirements, carbon adsorption should be a requirement of this OU because it would serve to reduce the mobility of hazardous substances into the environment. However, SARA offers other criteria that also must be considered, including long term maintenance costs and cost effectiveness. In this regard, Goodyear estimates that the capital cost for the installation of carbon adsorption units could range from $200,000 to $900,000 in capital costs (depending on whether an onsite carbon regeneration system is included). Thereafter, annual operation and maintenance costs could range from $100,000 to $200,000. Goodyear believes that such an approach, based on the interpretation of the proposed consent decree, would not meet the SARA "cost effective criteria" as the "effectiveness" criteria practiced by EPA in the administration of the Superfund program is based on a risk range of 10-4 to 10-7. Simply stated, we now know through the conceptual design that the TCE air emissions will not exceed this range regardless of whether air stripping with or without carbon adsorption is used. Thus, carbon adsorption simply is not cost effective.

As the August 8, 1988 "CERCLA Compliance With Other

Laws Manual" indicates, ARARS fall into three basic categories: (1) ambient or chemical specific requirements; (2) performance, design or other action specific requirements; and (3) location specific requirements. (Goodyear does not believe that this third category has any relevance to these discussions.) While this document and the August 27, 1987 EPA interim guidance indicate that a national ambient air quality standard is a type of chemical - specific ARAR, there are no such standards for TCE. Using the risk range of 10-4 to 10-7 as presented in the "Guidance on Feasibility Studies Under CERCLA" dated April, 1985, p. V-19 and in the "Superfund Public Health Evaluation Manual" dated October, 1986 (OSWER Directive 9285.4-1, pp. 91-93, section 8.32) as a guide, Goodyear has preliminarily concluded that, under the most conservative of circumstances,[2] the health risk of exposure to the air emissions from the air strippers, without carbon adsorption, is no worse than 10-4. Goodyear is developing additional data to support this position, which we will forward under separate cover. This will further verify our position that there will not be an unacceptable risk to public health if these contaminants are released into the environment in these de minimis quantities.

The second category of ARARS - "performance, design or other action specific requirements" - could arguably include carbon adsorption, if this requirement is viewed in a vacuum. However, as we have discussed above, this requirement must be viewed in light of other SARA requirements of cost effectiveness and adequate protection of public health. We believe that both of these requirements are met without carbon adsorption. In addition, assuming arguendo that these standards still apply, the waiver of such standards for an interim remedy also seems appropriate.

Accordingly, Goodyear proposes that subparagraph 5(c) of Paragraph VII of the consent decree be modified as follows:

> Air stripping will be used to reduce volatile organic compound ("VOC") contamination to meet federal and state standards. At the present time, relevant state implementation plan and Maricopa County requirements do not require sources of VOC emissions that are well below 40 pounds per day, such as the air stripping towers, to utilize carbon adsorption emission

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[2] The assumptions made include an emissions rate of 10 pounds per day for 70 years, continuous worst case meteorological conditions, and continuous exposure on a 24 hour basis.

controls. If the applicable requirements are revised to specify that sources such as the air stripping towers are subject to air emission control, then the provisions on modification in Paragraph XXV apply. Any dispute with regard to such emission controls shall be subject to dispute resolution in accordance with Paragraph XXII.

In summary, Goodyear has maintained its commitment to address the problems at the Litchfield site in a manner that will adequately protect public health and the environment. As it pursues this commitment, Goodyear anticipates that new facts will always emerge. The comments that we submit on this proposed consent decree today relate to refinements to the approach to be taken on the OU based on a better appreciation of the facts that we now have, and the applicability of CERCLA/SARA and related guidance documents to those facts.

Sincerely yours,

Takashi Ito

Takashi Ito
Attorney

TI:afj
Attachments
cc: Daniel W. McGovern, Regional Administrator, EPA
Jeff Rosenbloom, EPA
Hugh Barroll, EPA
Barry Sandals, DOJ

ENGINEERING-SCIENCE, INC.

2901 NORTH INTERREGIONAL
AUSTIN, TEXAS 78722
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October 2, 1987

Mr. Jeff Rosenbloom (T-4-2)
Remedial Project Manager
U.S. Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, California 94105

Re: Air Emission Controls on PGA Operable Unit

Dear Mr. Rosenbloom:

We received your letter of August 18, 1987 responding to our submission of the air quality modeling of the emissions from the volatile organic compound (VOC) stripping columns for the operable unit (OU) at the Phoenix-Goodyear Airport (PGA). As you acknowledged in your letter, the air quality modeling demonstrates that the uncontrolled emissions of trichloroethylene (TCE) from the stripper result in ambient concentrations well below the 0.769 $\mu g/m^3$ annual average which Table 9-6 of the *Public Comment Feasibility Study for Section 16 Operable Unit*, June 1987, cites as the lower cutoff limit for requiring air emission controls. In addition, modeling we performed for our comments on the above document demonstrates that maximum 24-hour concentrations of TCE are always less than 1 percent of the short-term exposure limit adopted by the American Conference of Governmental Hygienists. It is clear that the uncontrolled emissions of TCE from the stripping columns will not jeopardize human health or the environment.

In your letter you cite two bases for a policy decision that air emissions controls will be required on the VOC stripping columns: (1) the wording in Section 121(b)(1) of the Superfund Amendments and Reauthorization Act (SARA); and (2) Maricopa County Air Pollution Control Rules and Regulations, Regulation 3, Rule 32(c). We do not believe that the Agency is interpreting either of these rules correctly for this situation.

Section 121(b)(1) of SARA, as you state, indicates that preference should be given to remedial actions which *will result in permanent and significant decreases in toxicity, mobility, or volume of hazardous substances*. As you correctly point out, the mobility of the VOCs in the ground water is increased by air stripping. However, the statement that the *volume* of the contaminants is increased is incorrect - although the volume of the media in which the hazardous substance is distributed is increased substantially, the mass of VOCs emitted is constant and in fact is

substantially diluted in concentration. This dilution and increased mobility, in turn, decrease the potential exposure rate for any individual as compared to the ground water exposure potential, as demonstrated by the air quality modeling. It can be argued that although the TCE is unaffected by the transport from the water to the air in the stripper, the overall toxicity is reduced because of the substantial dilution which occurs in going from the water to the air.

As you have also acknowledged in the August 18th letter, Section 121(b)(1) of SARA also has explicit limitations on deciding whether a particular remedy is needed. With respect to long-term and short-term potential health effects (Section 121(b)(1)(D), we have already shown, and you have acknowledged, that the uncontrolled TCE emissions (by far the most significant air pollutant) from the stripping column pose no long-term and short-term health effects. Section 121(b)(1)(E) requires an assessment of long-term maintenance costs. The costs associated with removing the estimated 7 pounds per day of TCE from the VOC stripping column off-gas cannot meet any reasonable cost effectiveness test, as shown below.

As we documented in our comments on the OU public comment document, about 7 pounds per day of TCE will be emitted from the stripping columns. Other VOCs will amount to a total of not more than 3 pounds per day. For the purposes of this analysis, we assume that a total of 10 pounds per day of total VOCs will be emitted by the columns. Using a carbon loading of 0.1 pound of VOC per pound of carbon, 36,000 pounds per year of carbon will be required. At $2 per pound for replacement (includes custom regeneration), the annual operating cost is $72,000 for the air emissions control unit *excluding* the maintenance costs and capital costs for this equipment. This works out as a cost of $43,000 per metric ton of VOC removed *for the carbon replacement alone.* In its proposed rule for regulation of benzene under Section 112 of the Clean Air Act, the EPA's Air Office used a cost effectiveness value of $1050 per metric ton of VOC reduction to establish a size cutoff for facilities covered by the emission standards (*Benzene Fugitive Emissions - Background Information for Promulgated Standards*, EPA 450/3-80-032b, June 1982). EPA determined that controls at this level are not cost-effective for benzene, a carcinogenic air pollutant. In addition, EPA selected a cost-effectiveness limit for VOCs of $1600 per metric ton in setting guidance for 36 major organic chemicals (*Guideline Series (Draft) Control of Volatile Organic Compound Emissions from Air Oxidation Processes in Synthetic Organic Chemical Manufacturing Industry*, CTG, Office of Air Quality Planning and Standards, March 1984).

The cost of the air emissions controls for the PGA VOC stripping columns is more than an order of magnitude greater than the cost-effectiveness limits used by the Agency to evaluate air pollution controls for hazardous air pollutants and VOCs. We do not believe that SARA intends that control technologies which are so inefficient are to be mandated - that is, in our opinion, the reason that Sections 121(b)(1)(D) and (E) are included in SARA. We do not believe that this basis for EPA's requirement for emissions controls on the strippers is justified.

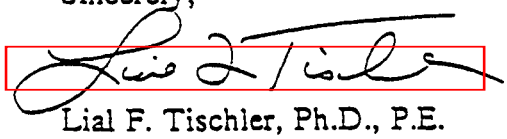
Maricopa County Air Pollution Control Rules and Regulations, Regulation 3, Rule 32(c) requires application for reasonably achievable control technology (RACT) for new VOC emissions sources under certain conditions. We spoke with Mr. Larry Crissafulli of Maricopa County Air Pollution Control (MCAPC) to determine how they apply this regulation to VOC stripping columns used for ground water treatment. The primary condition that MCAPC applies to determine if RACT is required for a new source is a minimum emissions rate of 40 pounds per day. At an estimated rate of 10 pounds of VOC emissions per day, the PGA air stripping columns are well below the de minimis level and should not require emissions controls. Mr. Crissafulli indicated to us that there are 5 to 6 stripping columns currently operating in Maricopa County and *none* of these have air emissions controls. One of these stripping columns is a large (32 foot high, 13 foot diameter) unit which strips TCE from a drinking water supply well in Scottsdale. The other columns all strip gasoline-contaminated groundwater which would contain benzene, toluene, and xylenes as well as other VOCs.

It is obvious that MCAPC does not interpret their regulation to require air emissions controls on de minimis VOC sources. This means that EPA's second basis for insisting on air emissions controls is also unjustified.

We respectfully request that the Agency reconsider the policy decision to require air emissions controls on the air stripping columns. Aside from the costs, we believe that the additional maintenance and operational requirements for the air emissions control device will be a very substantial addition to the operable unit. Since we will be routinely sampling the off-gas from the stripping columns, we will be able to verify that air emissions do not represent a hazard to human health and the environment. It emissions are greater than estimated, an air emissions control unit can be retrofit to the columns.

If you have any questions about our analysis and comments, please feel free to call me or Annette Ponds. We would look to further discussion of this issue during the Consent Decree negotiations.

Sincerely,



Lial F. Tischler, Ph.D., P.E.

xc: T. Ito, Goodyear
J. Smerglia, Goodyear
A. Ponds, ES

FENNEMORE CRAIG

Memorandum

To: Goodyear - PGA File

From: Fennemore Craig

Date: October 10, 1988

Re: Reasons Why Goodyear Should Not Be Required To Install A Control Device On Its Air Stripper Pursuant to Maricopa County Rule 32(C)

The Consent Decree

The Consent Decree for the PGA site provides in pertinent part as follows:

> Air stripping will be used to reduce volatile organic compound ("VOC") contamination to meet federal and state standards as prescribed in Table I of the 1987 ROD. The air stripping towers will be equipped with air emission controls in order, among other purposes, to meet Maricopa County requirements, including Rule 32-C and any other applicable provisions of the Arizona Implementation Plan under the Clean Air Act. If the Maricopa County requirements are revised and approved by EPA pursuant to the Clean Air Act to specify that sources such as the air stripping towers are not subject to air emission controls, then Goodyear may petition EPA to agree to amend this Consent Decree to remove the air emission control requirement of this Paragraph. Any dispute with regard to any such petition shall be subject to dispute resolution in accordance with Paragraph XXII. [Emphasis added.]

The Applicable Regulations

The Maricopa County Air Pollution Control Rules and Regulations, prior to July 15, 1988, provided in pertinent part as follows:

> Rule 32. Odors and Gaseous Emissions
>
> C. Materials including, but not limited to, solvents or other volatile compounds, paints, acids, alkalies, pesticides, fertilizer and manure shall be processed, stored, used and transported in such a manner and by such means that they will not unreasonably evaporate, leak, escape or be otherwise discharged into the ambient air so as to cause or contribute to air pollution; and where means are available to reduce effectively the contribution to air pollution from

evaporation, leakage or discharge, the installation and use of such control methods, devices or equipment shall be mandatory. [Emphasis added.]

Rule 34. Organic Solvents

E. Except as provided in paragraph C.2 [governing dry cleaning establishments], no person shall discharge more than 15 pounds of organic materials into the atmosphere in any one (1) day from any machine, equipment, incinerator, device, or other article in which any organic solvent or any material containing organic solvent comes into contact with flame or is baked, heat-cured, or heat-polymerized, in the presence of oxygen.

F. No person shall discharge more than 40 pounds of organic material into the atmosphere in any one (1) day from any machine, equipment, incinerator, device or other article used under conditions other than described in paragraph E of this rule for employing, applying, evaporating or drying any photochemically reactive solvent as defined in paragraph I of this rule.

G. Emission of organic materials into the atmosphere required to be controlled by paragraphs E and F of this rule shall be reduced by:
1. Incineration, provided that ninety percent (90%) or more of the carbon in the organic material being incinerated is oxidized to carbon dioxide, or
2. Adsorption, or
3. Processing in a manner not less effective than in Subsection G.1. or G.2. above.

H. The provisions of this rule shall not apply to:
1. The manufacturer of organic solvents, or the transport or storage of organic solvents or materials containing organic solvents.
2. The use of equipment for which other requirements are specified by Rule 33 [storage and handling of petroleum products].
3. The spraying or other employment of insecticides, pesticides or herbicides.

I. For the purposes of this rule, a photochemically reactive solvent is a solvent with an aggregate of more than twenty percent (20%) of its total volume composed of the chemical compounds classified below or which exceeds any of the following individual percentage composition limitations, referred to the total volume of solvent:

1. A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketones having an

olefinic or cyclo-olefinic type of unsaturation: five percent (5%);
2. A combination of aromatic compounds with eight (8) or more carbon atoms to the molecule except ethylbenzene: eight percent (8%);
3. A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene or toluene: twenty percent (20%).

Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group, that is, that group having the least allowable percent of the total volume of solvents. [Emphasis added.]

On or about July 15, 1988, the Maricopa County Board of Supervisors adopted a revised version of the Maricopa County Air Pollution Control Regulations. (These regulations are developed by the Maricopa County Department of Health Services, Bureau of Air Pollution Control, but it is the Maricopa County Board of Supervisors that votes to adopt the regulations as law.) Regulation III, Rule 320, Section 300 now provides the standards for the emission of odorous and gaseous air contaminants. In pertinent part, Rule 320 (replacing Rule 32-C) provides:

SECTION 101 PURPOSE: To limit the emission of odorous and other gaseous air contaminants into the atmosphere.

SECTION 300 - STANDARDS: No person shall omit gaseous or odorous air contaminants from equipment, operations or premises under his control in such quantities or concentrations as to cause air pollution.

SECTION 302 MATERIALS CONTAINMENT: Materials including, but not limited to, solvents or other volatile compounds, paints, acids, alkalies, pesticides, fertilizer and manure shall be processed, stored, used and transported in such a manner and by such means that they will not unreasonably evaporate, leak, escape or be otherwise discharged into the ambient air so as to cause or contribute to air pollution. Where means are available to reduce effectively the contribution to air pollution from evaporation, leakage or discharge, the installation and use of such control methods, devices or equipment shall be mandatory. [Emphasis added.]

Regulation III, Rule 330, Section 300 now provides the standards for the discharge of volatile organic compounds ("VOCs"). In pertinent part, this regulation (replacing Rule 34) provides:

> SECTION 301 LIMITATIONS - OPERATIONS INVOLVING HEAT: No person shall discharge more than 15 pounds (6.8 kg) of volatile organic compounds into the atmosphere in any one day from any machine, equipment, device or other article in which any organic solvent or any material containing organic solvent comes into contact with flame or is evaporated at temperatures exceeding 200 degrees F (93.3 degrees C) in the presence of oxygen, unless such discharge has been reduced by at least 85 percent.
>
> SECTION 302 LIMITATIONS - NON-COMPLYING SOLVENTS: No persons shall discharge more than 40 pounds (18 kg) of volatile organic compounds into the atmosphere in any one day from any machine, equipment, device or other article used under conditions other than described in Section 301 of this Rule for employing, applying, evaporating or drying any non-complying solvent as defined in Section 201 of this Rule, or material containing such non-complying solvent, unless its discharge has been reduced by at least 85 percent.
>
> SECTION 305 REDUCTIONS REQUIRED: Emission of organic materials into the atmosphere required to be controlled by Section 301 or 302 of this Rule shall be reduced by:
>
> 305.1 Incineration, provided that 90 percent or more of the carbon in the organic material being incinerated is oxidized to carbon dioxide, or
> 305.2 Adsorption, or
> 305.3 Processing in a manner not less effective than in Subsection above 305.1 or 305.2 of this Rule. [Emphasis added.]

EPA's Position

The proposed PGA air stripping tower will not release more than 10 pounds of TCE emissions per day, and will emit at that level for only a relatively short time. During most of twenty year operating period, emissions will be around 2.5 pounds per day. See Exhibit A attached hereto.

The EPA contends that Rule 32(C), a general regulation relating to odors and gaseous air contaminants, applies to the air stripper at the PGA site and imposes a separate mandatory requirement for carbon adsorption emission

controls. The EPA contends that Rule 32(C) (now Section 302 in Rule 320) requires Goodyear to install expensive carbon adsorption emission controls for volatile organic compounds even where such carbon adsorption otherwise would not be required under Rule 34(F) (now Section 302 of Rule 330), the rule specifically addressing VOCs. Rule 34(F) (now Rule 330) establishes a threshold VOC emission level of 40 pounds per day before carbon adsorption controls will be required.

ARGUMENT

1. Even if Rule 32(C) (now Rule 320) did apply, the EPA should defer to Maricopa County's interpretation that this Maricopa County regulation does not require carbon adsorption for the air stripping tower.

Maricopa County's Bureau of Air Pollution Control has reviewed the data concerning expected emissions from the air stripping tower and it has determined that carbon adsorption control devices are not required at the PGA site. In a letter dated October 3, 1988[1], Lawrence M. Crisafulli, a Public Health Engineer of the Maricopa County Bureau of Air Pollution Control, stated that, based on his examination of the probable emission of VOCs from the planned air stripper, the Bureau has concluded Goodyear is not required to install carbon adsorption control devices pursuant to Rule 320 [the present version of Rule 32(C)] or any other applicable regulation. This conclusion rests on the Bureau's interpretation of Rule 32(C) (now Rule 320), a regulation that was developed by the Bureau itself. So long as Goodyear complies with a few unrelated permit conditions, Maricopa County's Bureau of Air Pollution Control will allow air stripping to proceed without any carbon adsorption emission controls.

The EPA should defer to the interpretation of the Maricopa County Bureau of Air Pollution Control. The Bureau wrote the regulation at issue

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[1] A copy of that letter is attached as Exhibit B. Exhibit B refers to another letter dated September 29, 1988, which is attached as Exhibit C hereto.

(Rule 32(C)) in the first place and can better discern the intent of its own rules. The Bureau clearly has decided Rule 32(C) (now Rule 320) does not require carbon adsorption emission controls in the PGA air stripper.

In interpreting an administrative regulation, great deference is given the appropriate agency's understanding of that regulation. If the agency is interpreting regulations it drafted itself, deference is even more clearly called for. Sierra Pacific Power Company v. United States Environmental Protection Agency, 647 F.2d 60, 65 (9th Cir. 1981). An agency's interpretation of its own rule is normally given controlling weight unless it is plainly erroneous. Tele-Media Corp. v. FCC, 697 F.2d 402 (D.C. Cir. 1983) (citing Udall v. Tallman, 380 U.S. 1 1965)); see also Sainberg v. Morton, 363 F. Supp. 1259 (D. Ariz. 1973) (Secretary of Interior's construction of own agency's regulation controlling unless plainly erroneous or inconsistent with the regulation itself). If the agency's interpretation is merely one among several reasonable alternatives, it should stand even if another interpretation might appear more reasonable. Allen M. Campbell Construction Company General Contractors, Inc. v. Lloyd Wood Construction Company, 446 F.2d 261 (5th Cir. 1971).

The EPA frequently requests a court or other agency to defer to EPA's interpretation of any EPA regulation. EPA similarly should defer to Maricopa County's interpretation of a Maricopa County regulation. No carbon adsorption controls are required.

2. The EPA's interpretation of Rule 32(C), part of a general regulation on odorous and gaseous contaminants, is so broad it would render other, more specific regulations directly relating to carbon adsorption of VOCs superfluous and without meaning.

Rule 32(C) (now Rule 320) is a very broad and general section addressing "material containment" of a variety of odorous and gaseous materials. It does not require specific levels of emission reduction nor does

it specify a particular type of technology (i.e., carbon adsorption) to be employed in controlling emissions. The regulation on odorous and gaseous contaminants generally forbids any "unreasonable" discharge of "materials", including VOCs, into the air. It then provides that if means ("containment") are available to reduce any such "unreasonable" contribution to air pollution, the use of these means shall be "mandatory."

Maricopa County's Bureau of Air Pollution Control has already determined that the anticipated discharges of VOCs from the air stripper (less than 10 pounds per day) are not "unreasonable" and therefore do not require emission controls such as carbon adsorption. Furthermore, Rule 34(F) (now Rule 330) sets a threshold of 40 pounds per day before carbon adsorption emission controls will be required, clearly indicating that daily discharges that are well below that amount (i.e., 10 pounds) would be considered "reasonable" in the absence of carbon adsorption.

Under EPA's interpretation of Rule 32(C) (now Rule 320), however, any facility that releases VOCs into the air, even if well under the 40 pound limit set by Rule 32(C), must install carbon adsorption control devices to reduce even a de minimis level of air emissions whenever carbon adsorption would be "effective." Such a reading of the general regulation on odorous and gaseous air contaminants would render the specific 40 pound emission threshold (Maricopa County's judgment of the appropriate level at which to require carbon adsorption) completely superfluous. EPA's interpretation also distorts the intent of Rule 32(C) (now Rule 320), which was to permit Maricopa County to require simple "containment" measures to reduce emissions from VOCs, pesticides, fertilizer, manure, and the like, not to require carbon adsorption.[2]

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[2] Lawrence Crisafulli of the Bureau of Air Pollution Control explained that Rule 32(C)'s (now Rule 320's) general purpose is to ensure that simple and

The particular 40 pound limit of Rule 34(F) (now Rule 330) was carefully arrived at. It represents Maricopa County's assessment of discharge levels of VOCs which are "reasonable" in the absence of carbon adsorption. EPA's reading of Rule 32(C) to require every single "feasible" reduction of VOC emissions would make the 40 pound "carbon adsorption" threshold in the VOC regulation (Rule 34(F), now Rule 330) a complete nullity. If EPA were correct in its interpretation, every emission below 40 pounds per day of VOCs would have to have carbon adsorption controls (regardless of cost) if carbon adsorption would be "effective." If this were true, there would be no need for the 40 pound threshold in Rule 34(F) (now Rule 330).

Maricopa County's interpretation of its own regulations is consistent with generally accepted principles of statutory and regulatory construction.[3] "Fundamental maxims of statutory construction require that a specific statutory section qualifies a more general section and will govern, even though the general provisions, standing alone, would encompass the same subject." Trustees of Amalgamated Insurance Fund v. Geltman Industries, Inc., 784 F.2d 926, 930 (9th Cir.), cert. denied, 107 S. Ct. 90 (1986). Accord Union Central Life Insurance Company v. Wemick, 777 F.2d 499 (9th Cir. 1985) (refusing to read one section so as to render another superfluous); Pima County v. Heinfeld, 134 Ariz. 133, 654 P.2d 281 (1982) (en banc) (if two statutes deal with the same subject, more specific statute controls); Whitfield Transportation v. Brooks, 81 Ariz. 136, 141, 302 P.2d 526, 529 (1956) (if "there are two provisions applicable to the same subject, one general in its scope and the

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comparatively inexpensive means of reducing emissions (hence the title "material containment") are implemented even where expected emissions are below 40 pounds per day.

[3] Those same principles of construction that apply to statutes apply with equal force to rules and regulations promulgated by administrative bodies. Marlar v. State, 136 Ariz. 404, 410, 666 P.2d 504, 510 (App. 1983).

other covering a limited portion only of the subject included in the general one, the special statute is to be considered as governing the exception") (citation omitted).

The authorities cited above reiterate the logical proposition that a general regulation should not override a more specific regulation with which it is inconsistent. Therefore, Rule 34(F) (now Rule 330), the specific regulation on when to require carbon adsorption for VOC emissions, must govern with respect to the issue of carbon adsorption emission controls at the PGA site. No carbon adsorption controls are required because VOC emissions will be well below the 40 pounds per day threshold. Rule 32(C) (now Rule 320) does not govern because it is a less specific regulation and therefore cannot override Rule 34(F) (now Rule 330) on the issue of carbon adsorption.

3. Even if Rule 32(C) (now Rule 320) did apply to Goodyear's tower, the requirement of carbon adsorption control devices would be unreasonable within the meaning of the Rule.

Rule 32(C) requires only that the processing, storing, use or transportation of VOCs be "in such a manner and by such means that they will not unreasonably evaporate, leak, escape or be otherwise discharged"; and that where such "unreasonable" emissions otherwise would result, control methods shall be mandatory. This second clause in Rule 32(C) mandating control methods applies where means are available to "reduce effectively" any contribution to air pollution. The EPA's interpretation is based on reading this second clause in a "vacuum," standing completely by itself. This clause, however, also must be read in conjunction with the preceding clause in Rule 32(C) and its explicit reference to reasonableness.[4] Virtually any activity that contributes to air pollution can be further reduced, if enough money is committed to the effort.

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[4] As already discussed above, the clause in Rule 32(C) (now Rule 320) must also be read in conjunction with Rule 34(F) (now Rule 330). When read in conjunction with Rule 34(F), it is clear that carbon adsorption is not required unless VOC emissions are 40 pounds per day.

Rule 32(C) only mandates controls in the second clause if the emissions are initially determined to be "unreasonable" pursuant to the first clause of Rule 32(C).

Goodyear's proposed tower will not result in any such unreasonable discharges for two reasons. First, as already noted, the discharges are well under the "reasonable" threshold of 40 pounds provided for in the rule specifically addressing control of VOCs by carbon adsorption (Rule 34(F), now Rule 330); by the definition of Maricopa County, these discharges are thus reasonable in the absence of carbon adsorption controls. Second, the very concept of reasonableness implies a balancing of costs and benefits. The benefits of reducing VOC emissions below these already low levels are minimal; no significant health or environmental gain would be realized. The costs of carbon adsorption, on the other hand, are significant. Installation of a carbon adsorption unit is estimated at between $350,000 and $500,000. Operating costs would increase by approximately $88,000 per year, or $1,760,000 over a projected 20 year project life. Measured against the minimal good achieved by carbon adsorption in this case, such an expenditure appears exorbitant and unwarranted.

According to Mr. Lawrence Crisafulli, a balancing of costs and benefits is absolutely essential prior to any determination that carbon adsorption should be mandated pursuant to Rule 32(C) (now Rule 320), particularly since carbon adsorption was not the intended thrust of Rule 32(C). At present, preliminary cost evaluations indicate a carbon adsorption unit installation cost for the PGA air stripper would range from $350,000 to $500,000. In addition, operating costs are projected to increase from 16¢ per 1,000 gallons of water treated to 30¢ per 1,000 gallons of water treated. At

the projected flow rate of 1,200 gpm, the air stripper operating cost would increase from $100,900/year to $189,000/year. See Exhibit C.

If operating costs are considered alone, the cost of VOC air emissions controls is approximately $98,000 per ton of VOC removal. Id. In light of this cost data, it was the Maricopa County Bureau of Air Pollution Control's unequivocal opinion that Rule 32(C) [now Rule 320] does not require carbon adsorption emission controls for an air stripper unit with emission levels such as those anticipated for the PGA site. See Exhibit B.

Under Rule 32(C) (now Rule 320), it is Maricopa County's Bureau of Air Pollution Control that should decide if the additional benefits of carbon adsorption control methods in a situation involving VOC emission levels below 40 pounds per day are outweighed by the excessive additional costs of achieving further pollution reduction. By promulgating Rule 34(F) (now Rule 330), which explicitly states that emission level for VOCs below 40 pounds per day typically will not result in carbon adsorption controls, and by ruling that no further control device is necessary on the proposed air stripping tower at the PGA site, Maricopa County has concluded that the minimal benefits of carbon adsorption emission controls at the PGA site are easily outweighed by the prohibitive costs. The EPA should defer to the Maricopa County Bureau of Air Pollution Control when it comes to determining whether levels of VOC emissions in this situation would be "unreasonable" in the absence of carbon adsorption pursuant to Rule 32(C).

4. Rule 32(C) (now Rule 320) does not apply at all to Goodyear's proposed air stripping tower because Goodyear is not processing, storing, using or transporting the VOCs.

The EPA has focused only on the second clause of the sentence that comprised Rule 32(C), which stated as follows:

> "and where means are available to reduce effectively the contribution to air pollution from evaporation, leakage or

> discharge, the installation and use of such control methods, devices or equipment shall be mandatory."

The initial portion of Rule 32(C), however, makes it clear that it should apply only to regulated materials that are "processed, stored, used and transported." (The same language now exists in Rule 320, which replaced Rule 32(C) after July 15, 1988.) The thrust of the regulation is to require "containment" of materials that are being "processed, stored, used or transported," words that imply a commercial context.

The TCE at the PGA site will not be stored, used, or transported, nor will it be processed within the meaning of Rule 32(C) (now Rule 320). The term "process" connotes treating raw materials, chemically or physically, in preparation for introduction into the marketplace. See, e.g., Employment Security Commission of Arizona v. Brown, 109 Ariz. 183, 507 P.2d 108 (1973) (en banc) (vacuum cooling plant employees involved in "processing" lettuce because cooling the lettuce helps prepare it for market); Krienke v. Southwestern Superior Products Corporation, 376 S.W.2d 936 (Tex. Civ. App. 1964) (citing with approval a definition of "process" based on subjecting raw materials to manufacture, development, and preparation for the market). Given the fact that "process" applies generally in the context of commercial use (consistent with the general commercial context of the juxtaposed terms "stored, used or transported"), Goodyear's emissions of VOCs from an air stripping tower should not be considered "processing" of those VOCs within the meaning of Rule 32(C) (now Rule 320).

Rule 32(C) (now Rule 320) should not apply to the air stripping tower as Goodyear is not processing, using, storing or transporting volatile organic compounds.

AIR DISCHARGE OF TCE
(lbs/day)

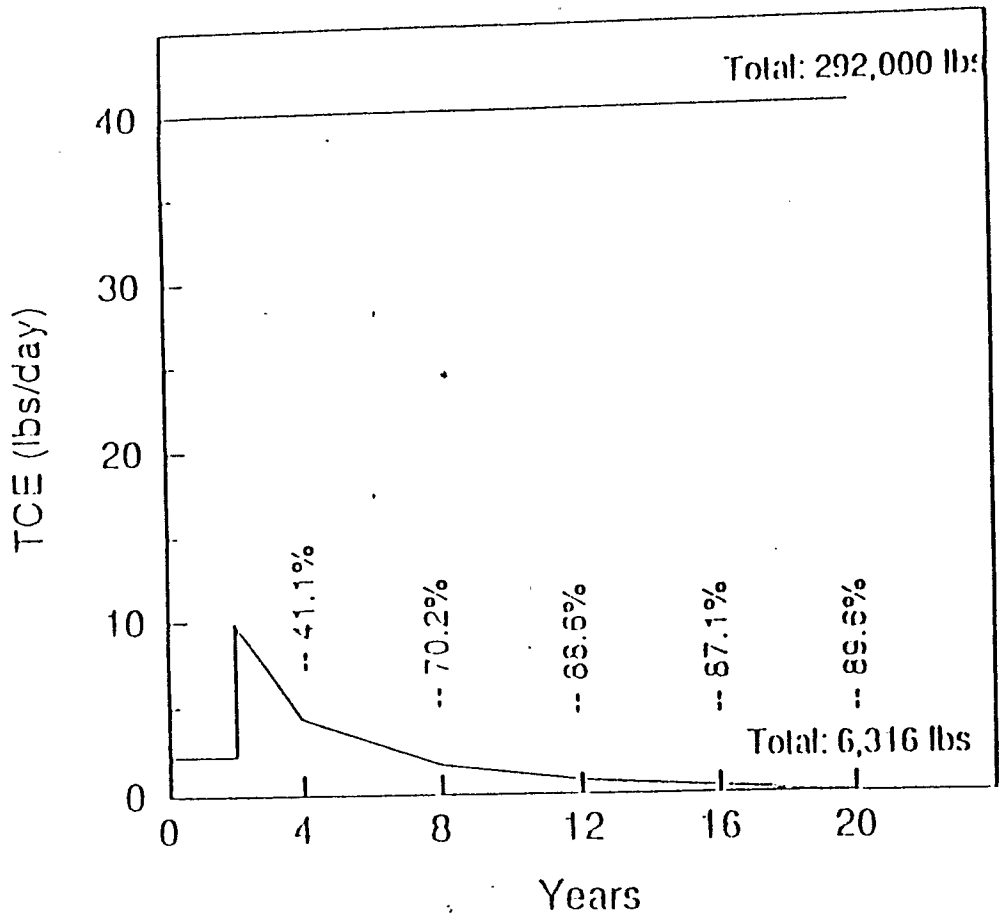


EXHIBIT A

Maricopa County
Department of Health Services

DIVISION OF PUBLIC HEALTH
Environmental Services

1845 East Roosevelt Street
Phoenix, Arizona 85006
(602)258-6381

October 3, 1988

Mr. Dale Papajcik
The Goodyear Tire & Rubber Company
1144 E. Market Street
Akron, OH 44316

Dear Mr. Papajcik:

The Maricopa County Bureau of Air Pollution Control (Bureau) has reviewed the information submitted regarding the proposed air stripper for treatment of contaminated groundwater at the Phoenix-Goodyear Airport Superfund site. Based upon the approximation of potential emissions of volatile organic compounds from the air stripper, as submitted in your September 29, 1988 correspondence, the air stripper may be proposed without a control device.

There is a requirement that Goodyear apply for an installation permit pursuant to the Bureau's Rule 210 (copy enclosed). I have also enclosed an information request outline defining the pertinent data required to be submitted as part of the application for the permit. There are normal permit conditions which the Bureau requires regarding monitoring the discharge of the air stripper. These permit conditions are for your information and do not need to be signed and returned at this time.

Should you have any questions regarding the above, please contact me at (602) 258-6381, Ext. 371.

Sincerely,

Lawrence M. Crisafulli

Lawrence M. Crisafulli
Public Health Engineer
Bureau of Air Pollution Control

LMC:sn

enc. Rule 200, 210; Installation Information Request;
Sample Permit Conditions

cc: Mr. Rolf von Oppenfeld, Fennemore Craig

PLN#4:97/sh

EXHIBIT 3

Maricopa County
Department of Health Services

DIVISION OF PUBLIC HEALTH
Environmental Services

1845 East Roosevelt Street
Phoenix, Arizona 85006
(602)258-6381

OPERATING PERMIT CONDITIONS

The soil venting system serving the Phoenix-Goodyear Airport site located at ( ), Phoenix, Arizona is subject to the following Permit Conditions (Maricopa County Bureau of Air Pollution Control Regulations, Rule 200, Section 303).

1. A test shall be made of the concentration of hydrocarbons emitted to the atmosphere from the vapor discharge vent to determine the emission rate in pounds per day. This test shall be conducted one (1) month after the initial startup date of this system. The following components shall be analyzed for: benzene, toluene, xylene, ethylbenzene, miscellaneous aromatics and total hydrocarbons. A written copy of the test results shall be submitted to the Bureau for review.

2. After the initial test is completed, future tests shall be conducted quarterly and written copies of these test results submitted to the Bureau for review. The components tested for shall be the same as in the initial test.

The operating permit issued shall be renewed annually, subject to compliance with these Permit Conditions and all other applicable regulations of the Bureau.

The Permit Conditions that are enumerated above are understood and agreed to by the undersigned permittee. Please sign and return with your Installation Permit Application.

Signed: _____ Date: _____

Title: _____

ENG#1:36/sh

THE GOODYEAR TIRE & RUBBER COMPANY
1144 E. Market Street
Akron, Ohio 44316

September 29, 1988

HAND DELIVERED

Mr. Lawrence M. Crisafulli
Public Health Engineer
Bureau of Air Pollution Control
Maricopa County Health Department
1845 E. Roosevelt
Phoenix, AZ 85006

Re: Air Emissions from future Air Stripping Tower
Phoenix-Goodyear Airport ("PGA")) Superfund Site
Goodyear, Arizona

Dear Mr. Crisafulli:

As you are aware, The Goodyear Tire & Rubber Company ("Goodyear Tire") has entered into an agreement in the form of a Consent Decree with the U.S. Environmental Protection Agency ("EPA") to treat groundwater beneath the Phoenix-Goodyear Airport Superfund site. The agreement requires Goodyear Tire to install a groundwater withdrawal and treatment system to treat water from the subunit A aquifer and remove excess concentrations of VOCs, principally trichloroethylene ("TCE"). At present our investigations indicate that approximately 1,200 gpm of water will be withdrawn from subunit A and treated by means of a packed tower air stripper. Attached for your use is a graph illustrating the projected total daily emission of TCE from the air stripping unit. Projected total VOC emissions represent only a minor increase over the TCE emission rates.

Based upon my understanding of Maricopa County Air Pollution Control Rules and Regulations, Regulation III, Rule 330, Section 302, an air stripper of the type being considered by EPA for the PGA site is exempt from an air emission control requirement for VOCs unless the unit emits a quantity of VOCs in excess of 40 lbs./day. If my interpretation is correct, then no air emissions controls would be required by Maricopa County on

EXHIBIT C

the PGA site unit. The unit will only emit, at a maximum, somewhere in the vicinity of ten pounds per day over a relatively short period of time as shown on the graph.

I understand, however, that Regulation III, Rule 320, Section 302 also allows Maricopa County some discretion on "containment" of air emissions from sources which emit less than 40 lbs./day VOCs. The regulation requires "material containment" such that VOCs "will not unreasonably evaporate, leak, escape or be otherwise discharged." (Emphasis added.)

At present our preliminary cost evaluations indicate a carbon absorption unit installation cost range from $350,000 to $500,000. In addition, operating costs are projected to increase from 16¢ per 1,000 gallons of water treated to 30¢ per 1,000 gallons of water treated. At the projected flow rate of 1,200 gpm, the air stripper operating cost would increase from $100,900/year to $189,000/year. If operating costs are considered alone, the cost of VOCs air emissions controls is approximately $98,000 per ton of VOC removal. In light of this cost data, it appears to me that the Section 302 provision was not intended to apply to air stripper units of the type proposed for the PGA site.

I respectfully request that you review the attachment and my discussion above together with your air emissions control policy. If the facts indicate that air emissions controls should not be mandatory or otherwise required for the proposed air stripper, please respond appropriately to me as soon as you are able. Resolution of this issue is very important to Goodyear Tire. Your cooperation will be kindly appreciated.

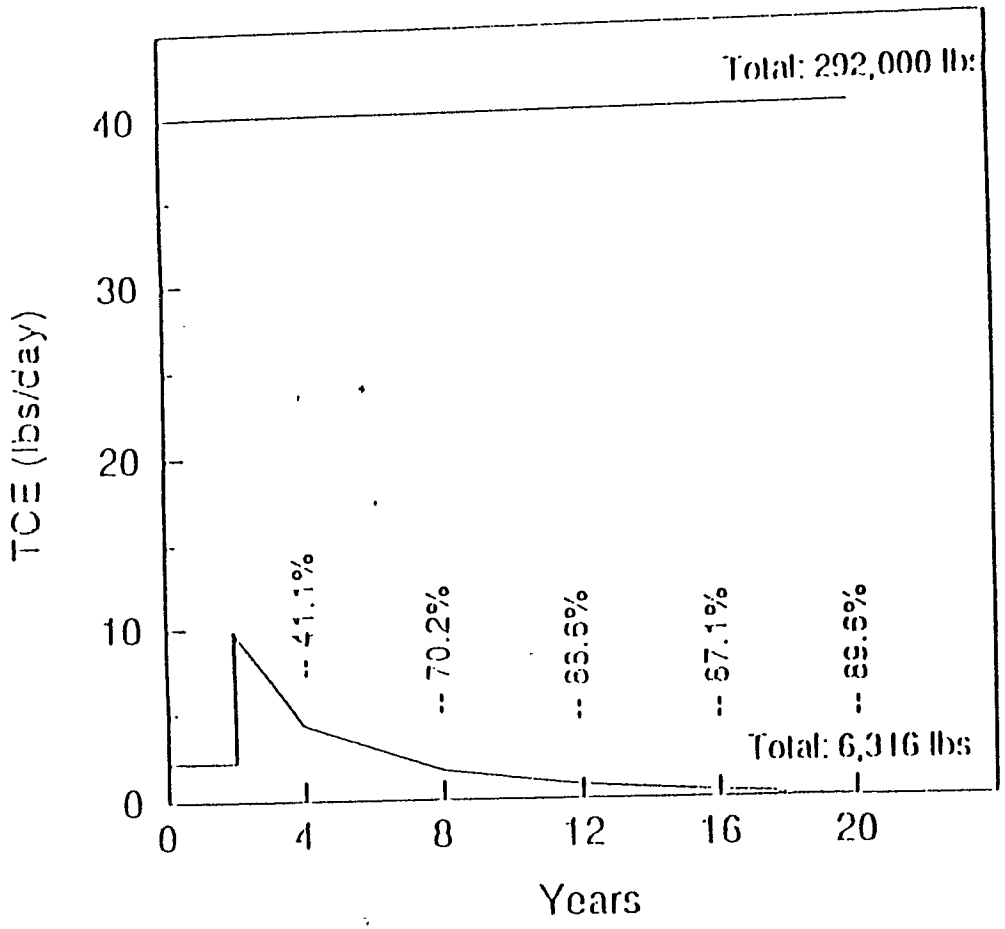
Sincerely,

THE GOODYEAR TIRE & RUBBER COMPANY

Dale E. Papajcik
Senior Environmental Engineer
Corporate Environmental Engineering

DEP:afj
Attachment

AIR DISCHARGE OF TCE
(lbs/day)



CH2M HILL

Black & Veatch
ICF
PRC
Ecology and Environment